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ABSTRACT

Despite the fact that the sky is the most dominant feature of our surroundings, it plays the role of an unseen background for many objects. It is the intent of this guide to bring about an awareness of the sky to young people. Topics for activities include: (1) "Sky Awareness"; (2) "Compass"; (3) "Hand Lens"; (4) "Prism"; (5) "Binoculars"; (6) "Thermometer"; (7) "Stars"; and (8) "Music Lesson" (including a list of songs and recordings pertaining to the sky). Recommended readings, an observation sheet, and a response form are also included. Appendices include the Beaufort wind scale, a wind-barometric table, humidity table, conversions, and a windchill table. Each section includes objectives, materials, vocabulary, an introduction, and several activities. This teacher's guide includes directions for setting up a weatherstation, tips for weatherstation activities, and a discussion of nighttime sky awareness. (CW)

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FOR SPACIOUS SKIES

A Teacher's Guide

SE 049 099

WAOW TV in Wausau, Wisconsin is one of the Television stations in American that is participating in the "For Spacious Skies" program involving our young people and communities in a study of the sky. We're happy to join "For Spacious Skies" in making this information available to you and to share our ideas with children, parents, and educators throughout the country. We're delighted to be a part of this program that, not only creates sky awareness of people here in North Central Wisconsin, but across America.

Wherever you live, one thing is certain, we're all under the same sky. A more sky aware society means not only sky appreciation, but sky conservation. All of us at WAOW TV-9...welcome you to FOR SPACIOUS SKIES!

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to increasing awareness of the appearance of the sky.

"Weatherwise and Otherwhys" courtesy of
Meteorologist Bruce Schwoegler, WBZ-TV, Boston, MA.

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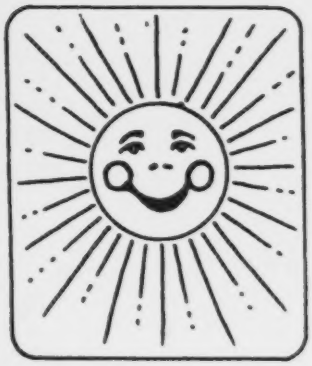
and "Experiments And Projects" courtesy of
Meteorologist Heidi Sonen, WAOW-TV, Wausau, WI



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*SPECIAL INSERTS WRITTEN BY METEOROLOGIST HEIDI SONEN

Preface

For Spacious Skies . . . . A Beginning

What an irony that the project devoted to giving you a potent, nonverbal sense of the environment should have come from the world of television. The very tube that frequently dulls us to the glories of nature became the bugle to rouse us. How did this happen? A set of person-on-the-street interviews on a main thoroughfare near Boston revealed that men, women, and children can go about oblivious to the wondrous sights overhead. Despite the fact that the sky is the most dominant feature of our surroundings, it exists as a kind of visual Muzak® playing out a role as an almost unseen background for airplanes, contrails, birds, kites, trees, buildings, and other "things."

One April morning when I was hiking through an Audubon Society sanctuary, I paused for a rest. I opened my eyes and, looking up at the clouds, came to the realization that I was seeing the sky for the first time.

This was no spectacular sky — no rainbow, no sunset gold, no lightning flashes. This was the "everyday" sky — possibly no more beautiful than the sky outside your classroom window as you read this booklet.

From that moment on, the sky has been a factor in my sense of place wherever I may be. Even in the midst of urban blight or suburban sprawl, the great canopy above displays what Thoreau has termed "another picture, painted and framed."

In June, 1977, I interviewed twenty-five people of varying ages. Putting my hand over each person's eyes, I asked, "How would you describe the present appearance of the sky?" Not a single person gave an accurate reply! Two months earlier, my answer would have been no better.

And what was the effect when these interviews were run on the news? They triggered scores of viewers into a fresh awareness like my own. Viewers and interviewees told me they experienced a new kinship with the natural environment, a new appreciation of art and photography, a new awareness of the air around us, and in some cases, a new sense of awe. The word "new" cropped up again and again. Now I understand what Proust meant when he said,

> "The true journey of discovery consists not in
> finding new landscapes but in having new eyes."

It is the intent of **For Spacious Skies**, through this Guide, to bring about "new eyes" in the young.

In order to present the concept of "SKY" within your classroom, you the teacher must begin with an emotional acknowledgment of its beauty and uniqueness. Only after you come to "see" the sky yourself can you then teach its richness and excitement to your class. Why not begin now?

What does the sky look like this very minute? Can you describe it in detail? Try first without looking out the window. Is the sky clear and blue? Are there clouds? What kind? Are they moving quickly?

If you are having difficulty remembering what the sky looked like, you are not alone. The activities that follow will focus on sky awareness.

Jack Borden
Founder and President
For Spacious Skies

These activities were put together with enthusiasm and great care. They are yours now. Share them with your students and feel good about the adventure that you and your children are beginning together.

C. Whitney Ward

Weatherwise and Otherwhys

By Bruce Schweigler

How high is the sky?

Blue skies become noticeably darker above 50,000 feet in the atmosphere. Most of our weather occurs beneath this boundary which is about two miles higher than commercial jets fly. Even though signs of the atmosphere continue hundreds of miles upward, the blackness and vacuum conditions associated with space environs are well established beyond an altitude of 100,000 feet.

Sky Awareness

OBJECTIVES

To create an awareness of and excitement about the sky
To develop the ability to observe the sky; to learn not just to look, but to "see"

INTRODUCTION

Tell the students that they are going to do a mystery experiment. Each will need a pencil and three pieces of paper. (Crayons may be used for kindergarten through second grade.) Take the class to a place in the school where it is quiet and there are no windows—an inside hallway or stage area with the curtains drawn are two possibilities.

Now ask the students to close their eyes and picture themselves back at home, just walking out the door on their way to school. Have them picture how they came to school—by car, by bus, or by walking. What did they see on their way to school? Did they see the usual, or anything unusual?

Then have them open their eyes. For kindergarten and first grade, ask the students to draw something they saw. Second graders can draw two or three things they remember seeing on their way to school. Third graders and up can write descriptions of what they saw. Have a number of students share these aloud.

After the sharing, ask if anyone drew or described the sky. Ask the class to raise their hands if they saw the sky this morning. They will all probably volunteer a hand. Then ask them to draw or describe on a fresh sheet of paper what the sky looked like. What color was it? If it was blue or gray, what shade of blue or gray? Were there clouds? Were the clouds moving? What shape were they? Were there any other things in the sky?

The students will begin to realize, as you elicit descriptive details, that they didn't really observe the sky very carefully. It is then that you should take them outdoors to look at the sky.

Once outside, start by showing the students how to observe. Note colors, shades, cloud formations, objects, and movements of the sky. Ask them to observe the atmosphere, or lower sky. This is the air envelope that surrounds us.

Go back into the classroom and have the students write BEFORE over their first descriptions of the sky. Then ask them to draw or write their new observations and label them AFTER.

Begin a group discussion by asking volunteers to share their drawings or statements. There will be excitement about what the students are beginning to see with their "new" eyes.

Tell the students that they will be learning more about the sky all year long. Remind them that the sky is really an ocean of air. If we lift one of our feet, there's a piece of sky under it!

ACTIVITIES

1. **Sky Journal (all grades):** Announce to the students that drawings or statements from the Introduction activities will be the first pages of their own For Spacious Skies sky journals. (It is also a good idea for the teacher to keep one and at times share some of the notations with the class.) Sky assignments will be included in the journal, but it should also be a place where the students feel that they can write spontaneously about happenings in the sky and feelings these happenings generate.

2. **Sky Checks (all grades):** Allow time for sky observations daily, both inside and outside the classroom. All it takes is 5 minutes or a quick glance out the window. Listen to your students' responses. They are expressing feelings about the sky when they see ice-cream cones in the clouds! The students should look for different colors, the moon (students love to find it during the day), the sun, birds, signs of fall, spring, winter, and so on. Findings may be charted along with temperature, wind direction, precipitation, etc.

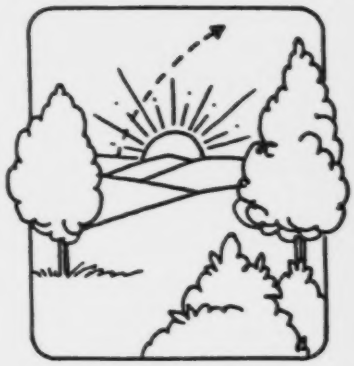
3. **Sky Assignments (all grades):** You will want to give sky assignments each night for the first several weeks and to work sky activities into daily lessons. The sky should become an important part of the students' daytime and nighttime activities.

4. **Sky Collage (grades 1-6):** Have the students cut out magazine pictures that use the sky as a dominant visual. Make individual collages or a collage mural.

5. **Sky Colors (grades 1-4):** Place an easel with blank paper at the back of the room or arrange drawing tablets on the chalk tray. Students can paint during free time. You will notice how their sky paintings will go from a sweep of blue across the top of the page and a circle of sun, to more sophisticated gradations of sky color and cloud representations.

6. **Sky Painting (grades 1-4):** Take easels outside one day and have the students paint like the masters! This would make a nice follow-up activity to a visit to a local art museum with an emphasis on viewing skyscapes.

7. **Sky Palette (grades 3-6):** Get a color-chip brochure from a paint store, with every gradation from white to gray to blue, including the reds and yellow-oranges of a sunrise and sunset. Ask the students to name each color, such as burning orange, quiet blue, etc. Put the chips and their color names on a large poster. This may be used each day for the sky check and may trigger some expressive language arts activities.



IMPORTANT

The sun's rays are very powerful

DO NOT LOOK DIRECTLY AT THE SUN!

8. **Sky Library (grades 1-8):** Have the students get books from the local or school library. Inform the librarian in advance of your Sky Awareness activities. Find magazine articles about the sky. The students can also work on their own sky books. Have them look for sky-related books at yard sales and add them to the library. Invite other classes to use the books.

9. **Sky Frames (grades 3-6):** Cut out a 15 cm x 15 cm (6" x 6") square from the center of a 21.5 cm x 28 cm (8 1/2" x 11") piece of cardboard. Have the students hold these frames up to observe the sky. Color chips and the four basic cloud formations (see Cloud Chart) may be attached to the outside border as a guide.

10. **Sky Mural (grades 1-4):** Get permission to set up mural paper in a public space in the school, maybe the library or cafeteria. Make crayons available. Invite students to draw pictures of the sky and to write sky thoughts.

11. **Sky Question Chart (grades 3-8):** The students will begin to ask questions about the sky. When they do, record the questions on a sky question chart. Each day post your own sky question for the students to solve. Examples: What makes the sky blue? Do we live in the sky? Are there clouds at night? Are there ever two rainbows in the sky?

12. **Clouds (grades 1-4):** Encourage the students to see familiar shapes in the sky: animals, mountains, giants, ice-cream sundaes. This is a good way to stimulate their imagination. Carry over their fantasies into creative writing. Give them some samples to get them started:

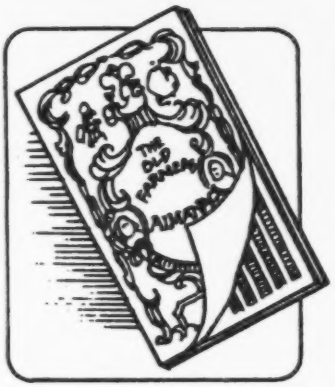
    The cloud lion roared this morning.
    I saw a banana split in the sky.
    The cloud giants were on parade.

13. **Daydreaming (grades 1-2):** Have the students lie on their backs outside and daydream about the sky. This makes for fun entries in their sky journals.

14. **Weather Wizard (grades 1-4):** Ask students to make up outrageous or humorous weather forecasts:

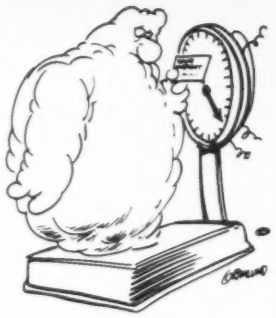
    Tomorrow there will be a storm of laughter.
    In Allacazoo the weather will turn blue.
    I am the weather wizard; I can tell weather from a feather.

15. **Weathercaster (grades 3-8):** You may have your students present an actual weather report using a sky/weather chart as a guide. They may set up a mock TV weathercaster's station.



Weatherwise and Otherwhys

By Bruce Schwoegler



How heavy is a cloud?

Clouds are packages of atmospheric energy buoyed by ascending air currents. One puffy cloud contains trillions of tiny water droplets with a combined weight of a half million tons. Thunderstorms weigh several million tons, and their watery loads approximate the energy in a 10,000 foot high hydroelectric dam.

16. **Sensory Activities (grades 1-2):** The sky is filled with tastes, smells, sounds, and feelings. Have the students "taste" the sky be catching snowflakes and raindrops in their mouths. "Smell" the sky with the changing seasons: a February thaw, the first blossoms of spring, the smell of wet leaves in the fall. "Feel" the sky on a winter's day by experiencing the icy winds, or feel the warm breezes in spring. "Hear" the sky in the rustle of blowing leaves, the roaring winds, the sound of an aircraft, or the songs of birds and insects.

17. **Photography (grades 3-8):** Instant photography is an excellent medium for sky awareness. Take daily instant pictures of the sky from one vantage point in the school yard. Have each student take a turn as a photojournalist who presents the photo and a brief "verbal snapshot" of the sky. Mount the photo and description on colored paper and display it daily outside your classroom door so that passing students can view it.

18. **Mystery Sky Photographs (grades 5-8):** Have the students take pictures of the sky, using blue, red, or green plastic *strips* over the lens of a camera. The results have a surreal appearance.

19. **Movies (grades 5-8):** Borrow or rent a sound videotape camera/recorder. Record a sunrise or sunset and students describing the phenomenon. Set this to some sky music (see Appendix) and show it for parents and other classes as a special event in your classroom.

20. **Sky Poetry (grades 1-6):** Read published "sky" poetry to the students. Ask them to write their own poems. Haiku is an excellent format for sky expression. The poems may be written on index cards and then pasted onto colored paper. Pictures may be drawn around each poem-card. Display these on mural paper.

21. **Sky Vocabulary (grades 1-6):** Each sky lesson generates sky words. These may be written on a chart and also individually on index cards with the definitions written in question form on the backs. Examples: Sky, What is the ocean of air?; Cirrus Clouds, What are high, white, wispy clouds called? These cards are excellent reference tools for sky journal writing.

22. **Sky Alphabet (grades 1-2):** Have the students make up and illustrate a sky word for each letter of the alphabet. Put the words together as an alphabet book.

23. **Mythology (grades 5-8):** Ask the students to create their own myths about the sky: how clouds form, why the moon shines, why there are thunderstorms, etc. These make for interesting comparisons with actual scientific facts about the subjects. Read ancient myths about the sky from other cultures. Discuss myth versus science.

Weatherwise and Otherwhys

By Bruce Schweigler

Can you smell rain coming?

Approaching rain can be smelled because falling atmospheric pressure and rising humidity cause releases of scents from objects and the ground. Particularly strong odors emanate from gas bubbles within vegetation and moist soil. They burst as lowered air pressure no longer confines them.

Rule Card

Never stare at the Sun even when you are wearing sunglasses. If you do, the Sun's rays can blind you.

24. **Sky Solo Experiences (grades 3-4):** Take the students outside and place them alone in various spots around the school yard. Have them watch the sky for 10-15 minutes and write down and/or draw how the sky makes them feel or what they are thinking as they watch alone. These may be recorded in their sky journals and shared with the group. (Sharing should not be forced; students must volunteer reading from their sky journals.)

25. **Sky Tales (grades 1-2):** The students enjoy telling sky tales: "I saw a rainbow in a puddle." "I saw a Sun Dog". "I watched the sunrise last week." Set aside 10 minutes each day to share sky stories. It allows the students time to talk about their sky experiences and gives them a chance to express themselves in front of the class.

26. **Sky Flags (grades 3-4):** Students can make their own flags by drawing pictures of the sky for the kind of day—sunny flag, cloudy flag, rain flag, etc. Display these in the classroom each day. Class flags may be made by drawing pictures with crayons, ironing the pictures onto white pillowcases, stapling them to wooden poles, and displaying them in class.

27. **Sky Corner (grades 5-6):** Set up a corner of the classroom or bulletin board for sky exhibits. This corner will be a good focal point for all sky activities. Here you may display sky drawings, creative writings, magazine and newspaper articles dealing with the sky, as well as photos the students have taken of the sky. Any other unusual sky material may be displayed.

28. **Sky T-Shirts (grades 3-4):** Students can make their own sky T-shirts. Use crayons or iron pictures onto T-shirts.

29. **Sky-A-Rama (grades 3-4):** Ask students to make a mural of the sky, depicting various sky conditions. The mural will fit all around the classroom to give a 360-degree view of the sky.

30. **Cloud Mobiles (grades 3-4):** The students can make sky mobiles. Use cotton balls on pictures pasted on cardboard or cut into the shapes of clouds, the sun, moon, planets, and stars. These may be displayed in the school hallways.

31. **Sky Playing Cards (grades 1-6):** Regular playing cards may be backed with pictures of the sky, clouds, etc. Match games may be played, such as "Go Fish." Using nature photos instead of numbers creates opportunities to visually discriminate cloud types, sky colors, trees, and animals.

Weatherwise and Otherwhys

By Bruce Schwoegler

How powerful is lightning?

A typical lightning bolt lasts less than a half second, is one mile long and generates 400 million horsepower. Some flashes leap 100 miles. Lightning's temperature is 50,000 degrees, five times hotter than the Sun. Each day, 8 million flashes light up worldwide skies creating 3.5 trillion horsepower, enough energy to lift 200,000 aircraft carriers 100 feet in the air.

32. **Sky Logo Design (grades 5-6):** Students can design sky logos with different themes: all the weather conditions into one logo, seasonal things into another logo, etc.

33. **Slide Show Creative Writing (grades 3-6):** Color slides of the sky tend to elicit oohs and aahs from young watchers. Use this opportunity to help the students transfer these feelings onto paper either in written form or through art activities.

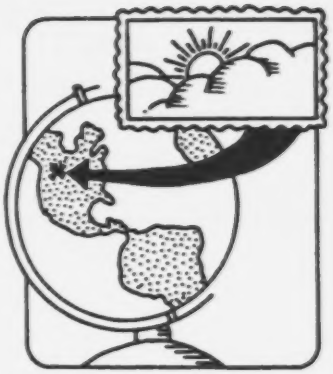
34. **Sky Alive Badges and Diplomas (grades 1-6):** Badges and diplomas may be given to students, teachers, visitors, parents, and others who show caring for the sky. Ask students to write letters to accompany the awards. This activity will develop letter-writing skills.

35. **Spread the Word (grades 3-6):** Have each student write a sky message (poetry, questions, a description of the sky that day). Add the student's name, age, and the address of the school to the message. Put each message inside a helium-filled balloon. Release!

36. **Sky Drawings of Other Worlds (grades 3-6):** Ask the students to imagine themselves living on another planet. Give them a quick trip through the solar system, using pictures, books, posters, and stories. The students then draw pictures of what the sky might look like on Venus, Jupiter, Mars, etc. Some may draw pictures of what the Earth would look like from the moon or farther in space.

37. **Seasonal Murals (grades 1-4):** Divide the class into four groups, one for each season. Have each group work independently on its mural, showing sky conditions and happenings of that season. Then combine the murals into a giant mural of the sky through the seasons. The effect of the tilt of earth's axis as it revolves around the sun may be discussed.

38. **Sky Advertising (grades 3-6):** Ask students to bring in pictures of the sky from magazine ads. Each student will make a sky collage. This activity will help the students become more attuned to how the sky is used in advertising and to the various moods created by different sky backgrounds.



Weatherwise and Otherwhys

By Bruce Schweiger

How is hail formed?

Hail is frozen atmospheric moisture which falls from thunderstorms. Strong updrafts within these cumulonimbus clouds waft small ice particles alternately up and down within the towering clouds which extend to frigid heights. One roundtrip sees a layer of water added to the ice pellet which then ascends, freezes and falls to accrue another water coating. Hailstones may gather twenty or more layers growing to golfball or even grapefruit sized proportions. One giant weighed nearly two pounds when it plowed into the ground near Coffeyville, Kansas, in 1970.

Compass

OBJECTIVES

To generalize the concept of direction
To understand how a compass works
To be able to use a compass independently

MATERIALS

poster paper, compass, town map, globe, graph paper, red pencil, index card, scissors, plastic straw, red paint or nail polish, straight pin, pencil with eraser tip, ribbons, Beaufort Wind Scale, chalk

VOCABULARY

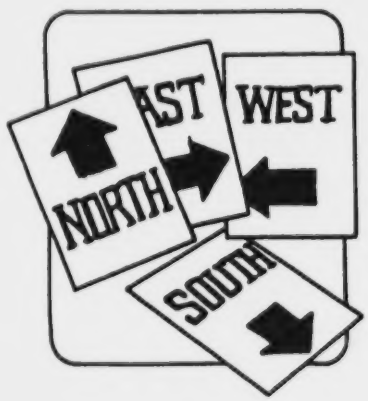
compass, compass needle, compass points, east, magnet, north, North Pole, south, west

INTRODUCTION

Display a "treasure map," a map with three to four directions drawn in a crude map form on poster paper. Example: Take three steps *north* of the pencil sharpener; now take two steps *south* and four steps *east*. Tell the students that they are going to have a treasure hunt. You have hidden something in the room. (If it's a nice day, you may do this outdoors.) In order to find the treasure, they will have to read the map and follow the directions.

Ask for a volunteer. He or she should stand next to the pencil sharpener. Read the first direction and ask the student to guess which direction is north and then to proceed in that direction. No matter which direction the student chooses, ask the class if it is north. This should generate a lively debate. Ask students how we can tell for sure where north is.

Establish the concept of north by finding out which classroom is north of yours, what major points in town are north of your school (use a town map), what state is north of yours, what country is north, etc., until you get to the *North Pole*. Then discuss the fact that from that point on the direction reverts to south. Show this on a globe. Continue this teaching mode with the other *compass points*.



Explain that the *compass needle* always points north (unless it is near magnetic material) and that you simply move the N on the compass to where the colored tip of the needle is pointing. Why is the needle always pointing north? It is magnetic and lines up with the giant imaginary *magnet* that runs through the earth. (For older students this topic may be expanded for a science project.)

Establish where north is in the classroom. Post and label it. Come back to the treasure map and work on finding south and east and, by the process of elimination, *west*. Establish these on the compass, label the room, and have the volunteer finish walking the map to find the treasure (free-time tickets to use the compass for everyone in class).

ACTIVITIES

1. Establish directions within the classroom. Have the students label their desks N, S, E, and W.

2. Have each student make a simple line drawing connecting five dots on graph paper. Designate the beginning of each drawing with a red dot. Then have the students write out directions for drawing their designs in terms of north, south, east, and west. The students exchange written directions to test if other students can follow them and come up with the same drawing.

3. How can you tell which way the wind is blowing? Have the students observe the flag on the flagpole, smoke rising, leaves blowing, etc.

4. Take the students outdoors on a day when wind is blowing. Show them that the quickest way to establish wind direction is to stick a finger in their mouth and, while the finger is still wet, hold it up into the air. The side of the finger that feels coolest is the direction the wind is coming from. This will lead to a discussion of naming that direction; confirm the direction with the compass. (Wind direction is always designated as the direction it is coming *from*.)

5. Make a simple wind vane. Cut an index card into an arrowhead shape. Cut a 1-cm (½") slit at the indented end. Flatten one end of a plastic straw and insert it into the slit. Paint the other end of the straw red. Balance the straw on your finger to find the balance point, and then insert a straight pin at that point. Stick the pin into the eraser of a pencil. Have the students take the wind vane outdoors and track the wind each day. Record the direction on a weather chart. You may also attach 30-cm-long (12") ribbons to a vertical pole in the school yard and observe the wind direction.

6. Have the students listen to daily weather reports and note the wind direction. Also have them check a newspaper weather page each morning for wind information.

7. Place on the bulletin board a Beaufort Wind Scale (see Appendix). The scale gives clues to estimating wind speeds by sight.

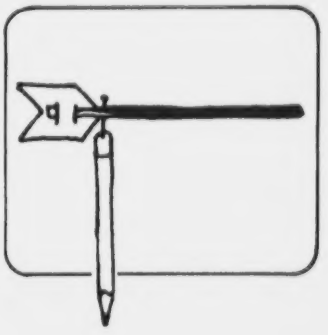
8. Study shadows as indicators of direction. Observe natural shadows in the school yard. Then study people shadows. Have the students work in pairs to draw each other's shadow in chalk on a sidewalk. Label each with the student's name and time of day.

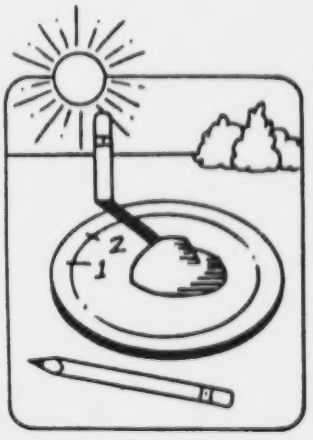
Weatherwise and Otherwhys

By Bruce Schweigler

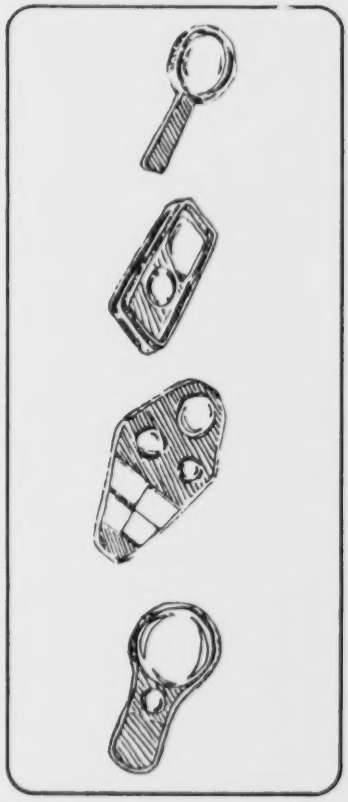
Why does the wind often die at sunset?

Aloft, winds blow with varying speeds almost continuously. Near the Earth's coarse surface, friction retards them. Sunlight generates warm air currents which ascend and link the bottom and top environments. This bond enhances a transfer of momentum from winds aloft to those below. Sunset severs the tie, and friction takes over.





Hand Lens



OBJECTIVES

To observe visual details
To learn the basic concept of magnification

MATERIALS

balloons, string, scissors, magic marker, hand lens, small box, glass microscope slide, grease pencil, medicine dropper, water, newspaper

VOCABULARY

clear, deflate, enlarge, focus, hand lens, magnification, magnify, scale drawing

INTRODUCTION

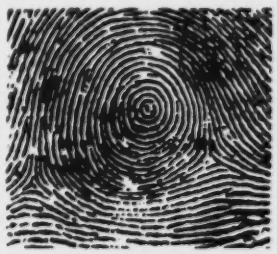
Give each student a balloon. Ask the students to blow up the balloons and tie the ends with string. The balloons may be *deflated* later. Each student will now print his or her name on the balloon with a magic marker. After all have done this, begin a launch countdown from 10 to zero. At the count of 2, the students should untie their balloons but hold onto the ends. At the zero count they will release the ends, and the balloons will shoot up into the air. The students should then retrieve their balloons. Tell them to check the names to be sure they have their own. Ask if anyone had difficulty reading the names. Ask how the names could be made easier to read. Someone should suggest they could blow up the balloons again.

You have now set the stage for introducing *magnification*. Lead the students into a discussion of why they had to blow up the balloons in order to be sure of the owners' names. When they begin articulating the concept of things appearing larger, bring out the *hand lens*.

ACTIVITIES

1. Ask the students if they have ever studied their fingerprints. Do their prints have whorls or arches? Illustrate the two patterns on the board. (See the figure in the margin.) Have them look at their fingertips with the hand lens to find out.

2. Teach the students a focusing technique. Hold the hand lens about 10 cm (4″) from the eye. Hold an object about 15 cm (6″) from the hand lens. Move the object or the hand lens slowly up and back until the object is *clear*. Explain that the object is now in *focus*.



Whorl pattern

Arch pattern

3. Take the students outdoors to collect things to study with the hand lens. Put the things in a box and set up a study table in the classroom. Begin making a list of "discoveries," things that can be seen with the hand lens but that are not usually noticed with the naked eye.

4. Each student will choose a small 30-cm-square (12″ × 12″) observation spot outdoors. This may be the trunk of a tree, a patch of concrete, etc., and will be their "spot" to observe daily with the hand lens. Ask them to record the date and time, what they see, and to note what changes, if any, occur.

5. The students can make water drop magnifiers. Draw a 1-cm (⅜″) circle with a grease pencil on a glass microscope slide. Use a medicine dropper to place a drop of water inside the circle. Hold the slide over some newsprint to test the *magnifying* power.

6. Have the students catch snowflakes or scrape frost crystals from a frosted window or items taken from a freezer. The students can observe these through a hand lens and then draw what they see.

7. Ask the students to bring in canceled postage stamps. Have each student make an *enlarged scale drawing* of a stamp by using the hand lens.

IMPORTANT

The sun's rays are very powerful

DO NOT LOOK DIRECTLY AT THE SUN!

Prism

OBJECTIVES

To identify and use a prism
To describe white light as being made up of many colors

MATERIALS

prism, clear tape, poster paper, pocket mirror, glass of water, hand lens, easel with blank paper

VOCABULARY

prism, rainbow, refraction, spectrum, white light

INTRODUCTION

The element of surprise may be used to introduce the *prism*. Before the students arrive in the morning, secure the prism to the classroom window with clear tape. When the *spectrum* appears, gather the students into a group to begin the lesson. Before you launch into a full explanation, however, see if the students can come up with an explanation on their own.

ACTIVITIES

1. Show the students a sheet of poster paper with the word PRISM scrambled MSIRP at the top. See if they can decipher the letters. When they do, ask: Where did the *rainbow* come from? What colors can we see? Will the rainbow stay in the same place all day?

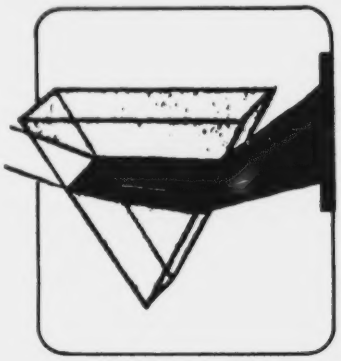
2. Discuss *refraction*, the bending of light as it passes from one medium into another. This will lead to a discussion of a spectrum, the seven colors (red, orange, yellow, green, blue, indigo, and violet) that emerge when *white light* passes through the prism.

3. Put all new vocabulary words on the prism poster. Generate a list of adjectives that describe the prism rainbow bright, vivid, vibrant, etc.

4. Chart the path of the "rainbow" through the morning. Do this for three days and discuss the findings. Formulate conclusions and follow up with a unit on the sun and rotation of the earth.

5. Discuss rainbows that appear in the sky. Tell the students that the Norse called rainbows "bridges of the sky." Explain that rainbows are made in the same way as the rainbow in the classroom. Raindrops act like prisms, and the refracted light forms a spectrum that we see as a rainbow in the sky.

Weatherwise
and Otherwhys
By Bruce Schwoeglet
Why is snow white?
Sparkling six-sided snow crystals reflect all colors of the spectrum back to your eyes. This color flood is seen as white. A hole in the snow is often tinted blue because light ricochets within the snowpack and loses colors such as red, while blue is not absorbed and is transmitted to your eyes.



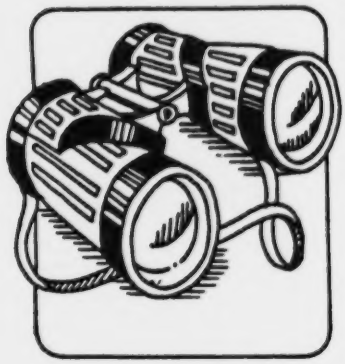
6. Lean a pocket mirror in a glass of water. Put it in front of a window. The colors of the spectrum can be seen. Have the students examine this "rainbow." Are the colors the same as in the one formed by the prism? Students may use the hand lens to examine the color bands more carefully.

7. Have the students create short poems or haiku about rainbows. Example: A rainbow danced on Erica's shoe. At noon it skipped to David's.

8. For an eye-hand coordination task, have the students manipulate the prism so that, in turn, the rainbow lands on each student's hand. They may write in their sky journals what it feels like to hold a rainbow in their hands!

9. Place the prism so that the rainbow falls onto an easel with blank paper set up at the back of the room. The students can make drawings incorporating the "rainbow."

Binoculars



OBJECTIVES

To extend the concept of magnification
To develop observational skills
To observe and record sky phenomena

MATERIALS

binoculars, bird feeder, bird seed, bird identification guide, compass, Cloud Chart, hand lens

VOCABULARY

binoculars, image, lens

INTRODUCTION

Preselect an object that may be seen from the classroom window but not seen in detail. Examples: numbers on a telephone pole, license plates, details on a distant house or building. Bring the students to the window and ask them how they might see these things more clearly. They already will have been introduced to the hand lens and will have the concept of magnification. If they do not realize that the hand lens does not work at a distance, ask someone to test it. If someone suggests *binoculars*, bring out the binoculars. Have each student look through the binoculars at the object. The question of focusing will now come up.

Focusing: Explain that the two *lenses* on each side of the binoculars may be moved to focus the *image*. After you give a class demonstration, tell the students that if they are having any difficulty, they can ask someone who has mastered the technique. Display a chart of the step-by-step focusing technique (see the list below).

1. Put the binoculars to the eyes and aim at an object.
2. Close the right eye.
3. Look at a fixed object with the left eye and press the focus lever located at the top of the binoculars.
4. Close the left eye. Look at the same object and again press the lever to bring the object into focus.
5. Now open both eyes. Twist the right eyepiece so that the object is in focus for both eyes.
6. If you wish to see an object closer or farther away than the first, repeat the focusing steps.

ACTIVITIES

1. Set out a bird feeder on a tree and have the students keep a daily log of bird sightings. The level of bird seed may also be checked through the binoculars. The students can learn to describe birds by size, shape, coloration, etc. Keep a bird identification guide next to the binoculars.

2. The students should keep a daily vigil of the sky. Have them observe and record objects seen in the sky. Example: object, airplane; colors, red and white; shape, long and narrow with wings; number of engines, three; identification, TWA on tail.

3. Have the students observe birds, kites, or other objects in flight and discuss how these objects move. These are details better observed with the binoculars.

4. Have the students use a compass to determine the direction of birds, airplanes, balloons, etc. Place the compass on the ground and turn it until the colored part of the needle points to the N. Now students can check and record the direction of the next ten aircraft, birds, or other moving objects.

5. Choose objects seen at a distance, such as a church steeple, TV tower, etc. Write clues about them, incorporating compass directions and verbal riddles. Have the students attempt to solve the riddles. Example: This is something that is always slow. It is west of the big oak tree in the yard. It is just south of the church steeple. (Answer: The town clock—it's always 20 minutes slow!)

6. As you did with the hand lens, have each student pick out a private study spot, one that may be seen from the classroom window. Have students record what they see over several weeks' time.

7. Have the students use the Cloud Chart to identify the types of clouds seen each hour over a two-week period. With the class, examine the data to determine if any special sequence occurs. Does any one cloud type precede another? Do certain cloud types precede rainfall? Have the students draw enlargements of the cloud types found on the Chart. Post on the bulletin board the cloud type in the sky that day. This is especially helpful for classrooms that do not have a clear view of the sky.

IMPORTANT

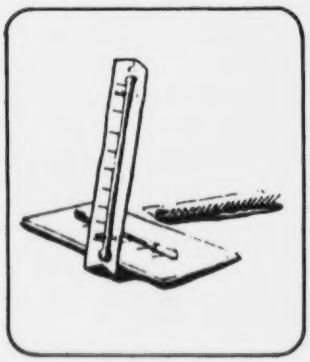
The sun's rays are very powerful

DO NOT LOOK DIRECTLY AT THE SUN!

Thermometer

OBJECTIVES

To learn how to use a thermometer
To make simple predictions about the weather



MATERIALS

chart paper, red and blue markers, thermometer, bowl of ice, hot plate, tea kettle, Celsius Fahrenheit temperature chart, small piece of cotton cloth, thread, string, water

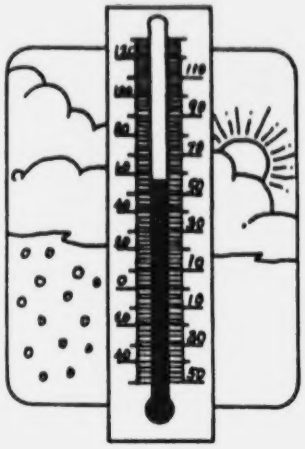
VOCABULARY

boiling point, Celsius, contraction, expansion, Fahrenheit, freezing point, psychrometer, relative humidity, temperature, thermometer

INTRODUCTION

Write the word "sizzle" in red at the top of a piece of chart paper. Ask what the word means. Discuss things that sizzle, such as french fries when they are cooking, meat on a barbecue, etc. Now, write the word "brrrrr" in blue at the bottom of the chart. Do the same verbal exercise as with "sizzle."

Ask how hot something would have to be to "sizzle" and how cold a "brrrr" would be. Discuss how *temperature* can be measured. Bring out the *thermometer*.



This is a good introduction to determining the boiling and freezing points of water. Have the students hold the thermometer in a bowl of ice and record the *freezing point* 32° *Fahrenheit* or 0° Celsius. (This would be a good time to discuss *expansion* and *contraction*. Have the students note the movement of the red-dyed alcohol in the thermometer.)

Then, hold the thermometer in the steam coming from a tea kettle. Record the *boiling point*, 212° Fahrenheit or 100° Celsius. (Boiling and freezing points depend upon altitude and impurities, so the measurements may not be exact.) Although the Celsius scale is now used almost universally, discuss the Fahrenheit scale and offer a comparative chart.

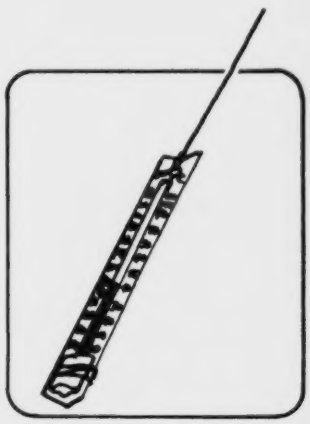
ACTIVITIES

1. Take the class outdoors to take temperature readings at different points in the school yard. Note and discuss any temperature differences.

2. Secure the thermometer outside in a shady spot. The students can take readings daily and record these on a weather chart, along with measurements of rain, wind direction and speed, cloud configurations, and any other sky weather phenomena that are noticed.

3. Each day check the weather page of the local newspaper to see what is predicted. Have the students listen to the evening weather forecast and write down what is predicted. Keep track of the accuracy.

4. Begin to predict the weather as a class project. It will be necessary to take a measure of the *relative humidity*. To do this, you will need to make a *psychrometer*. Explain that to measure the humidity in the air you will have to determine the difference between the readings of a "dry" and a "wet" thermometer. First, record the reading of the dry thermometer. Now wrap the bulb of the thermometer with a small piece of cotton cloth. Tie the cotton securely with thread. Tie a 30-cm (12") piece of string to the hole at the top of the thermometer. Wet the cloth and swing the psychrometer around in a circle about 30 times. **CAUTION**: Be sure that the students stay clear of the swinging thermometer. As the water evaporates from the cloth, it will lower the thermometer's temperature reading. The difference between the two temperatures will be indicative of the percentage of humidity in the air. The greater the temperature difference between the two thermometers, the lower the humidity. When the temperatures are the same, the relative humidity is 100%. Use the table (see Appendix) to determine the relative humidity.



5. As the students become more proficient at measuring and observing various weather predictors, they could put together their own weather forecasts just like on TV. They might like to issue a daily weather report to be posted in the school cafeteria or announced over the school public address system.

6. Have the students write letters to a local TV weather forecaster and invite him or her to visit the class.

Stars

OBJECTIVE

To observe and track objects in the evening sky.

MATERIALS

*Sky Challenger, black and dark blue construction paper, colored star stickers, magic markers, glue, mural paper, binoculars, chart paper, oatmeal carton, scissors, cardboard, nail, flashlight, fluorescent paint, straight pin, black photographic slides, slide projector.

VOCABULARY

Big Dipper, constellation, horizon, Little Dipper, North Star, planet, star.

INTRODUCTION

The Sky Challenger provides a step-by-step introduction to the night sky. Introduce the Sky Challenger by arranging a night field trip. If this is not possible, bring the night sky into your classroom.

Give each student a piece of dark blue construction paper and a dozen colored star stickers. Have the students toss the *stars* all at once onto the paper and glue the stars where they land. Suggest that, if they look carefully, they might see a hidden animal or other object in the star pattern. Elicit responses. Have the students outline with magic markers their "found" animals or objects and name them.

ACTIVITIES

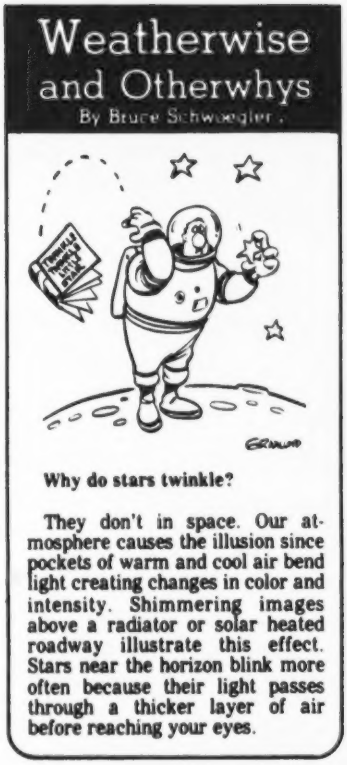
1. Introduce the word *constellation*. Show the students the star wheel with the Native-American constellations on it. Read some of the tales on the back. Now have the students create stories about their star creatures and record them in their sky journals.

2. Glue the students' constellation pictures onto a large piece of mural paper like a patchwork quilt and mount it onto a wall. The students may take turns telling the class stories about how their constallations got into the sky.

3. Insert the introductory star wheel into the Sky Challenger holder and explain how to adjust the wheel for the correct month, day, and time. Follow the directions on the back of the Sky Challenger holder.

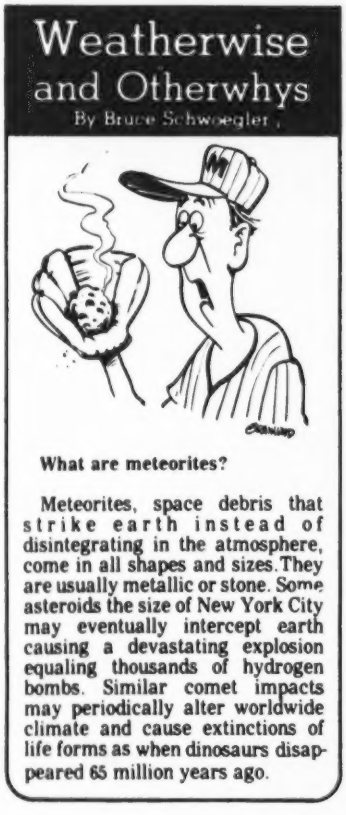
4. You may need to review compass directions and discuss north, east, south, and west with regard to the *horizon* and the sky. Begin with north. Find the *North Star* on the star wheel and explain how to find it easily in the night sky. (First find the *Big Dipper*. Draw an imaginary line through the two end stars going north until you reach the bright star in the handle of the *Little Dipper*. That is the North Star). The North Star will be in about the same position each night, so the students will be able to find other stars in relation to it.

*Sky Challenger available from Delta Education, Box M, Nashua, NH 03061-6012.



Why do stars twinkle?

They don't in space. Our atmosphere causes the illusion since pockets of warm and cool air bend light creating changes in color and intensity. Shimmering images above a radiator or solar heated roadway illustrate this effect. Stars near the horizon blink more often because their light passes through a thicker layer of air before reaching your eyes.



What are meteorites?

Meteorites, space debris that strike earth instead of disintegrating in the atmosphere, come in all shapes and sizes. They are usually metallic or stone. Some asteroids the size of New York City may eventually intercept earth causing a devastating explosion equaling thousands of hydrogen bombs. Similar comet impacts may periodically alter worldwide climate and cause extinctions of life forms as when dinosaurs disappeared 65 million years ago.

5. For their first nighttime sky assignment have the students locate the North Star. Then work through all the sky star wheels, planning activities around each.

6. Have students take turns borrowing the class binoculars to take home for sky observations.

7. Record sky sightings on chart paper, being sure to record the date, time, horizon, description, name, number of stars visible, brightness, etc. Be sure the students also record the moon's configuration: full, new, first quarter, last quarter, etc.

8. Plan an evening field trip. This should involve parents and could include a sunset watch. Remember, no two sunsets are alike, and the sky begins to change color a good half-hour before sunset. An early morning sunrise watch would also make an interesting class activity culminating in a family breakfast at school.

9. Post a chart that gives the best conditions for star gazing:
   a. Pick a clear, dry, moonless night away from city lights. If you are in a city, find a spot where a tall building blocks the bright lights.
   b. To catch the brightest stars, go outside just after sunset. The dimmer stars can be seen later.
   c. Adjust your eyes to the dark by closing your eyes for a few moments and then opening them. Do not look directly into street lamps or other bright lights.
   d. If you use a flashlight, wrap it in red transparent cellophane and secure with tape. This will allow you to see but will not alter your eye adjustment.
   e. For best viewing, put old blankets on the ground and lie on your back.

10. Plan a field trip to a local planetarium or a university observatory.

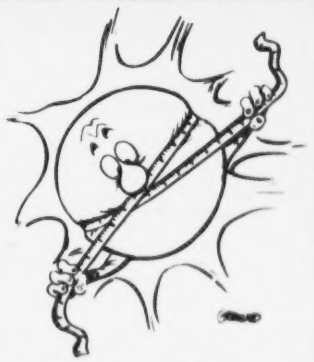
11. Make a constellarium. Cut off the bottom of an empty oatmeal carton. Cut out the center of the carton's lid, leaving 1 cm (1/3″) all around the edge. Cut cardboard circles that fit snugly into the lid. With a nail, punch holes in the circles to mimic constellations. Slip the circles into the lid one at a time and shine a flashlight through the other end of the carton. Show the constellations on a wall or ceiling in a darkened room.

12. Paint stars, constellations, and *planets* on black paper with fluorescent paint. Hang these on the wall or ceiling of the classroom. Turn off the lights, close the shades, and enjoy the "night sky"!

13. Use a straight pin to poke a series of holes in black photographic slides to resemble constellations. Show them on a slide projector.

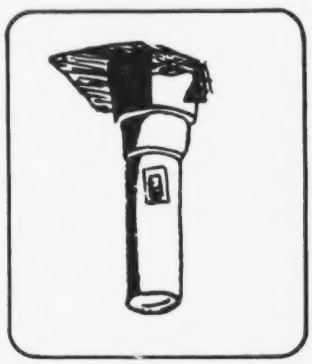
Weatherwise and Otherwhys

By Bruce Schwoegler



How big is the sun?

Our fiery star is a small fry in space but is much larger than any of the planets in our solar system. Its diameter measures 865,500 miles. If a man's height equaled the diameter of the sun, Jupiter, the largest planet, would be a bit smaller than a man's head. Earth would be the size of the tiny iris in the man's eye.



Music Lesson

OBJECTIVES

To identify sky themes in popular and classical music
To integrate sky music into activities

MATERIALS

record player, variety of "sky" recordings

VOCABULARY

melody, tempo

INTRODUCTION

Choose three popular sky songs (see Appendix). Play all three for the students. Have them guess what is similar about all three songs. Elicit responses regarding the *melody, tempo,* or type of music. Make a list of sky songs the students know.

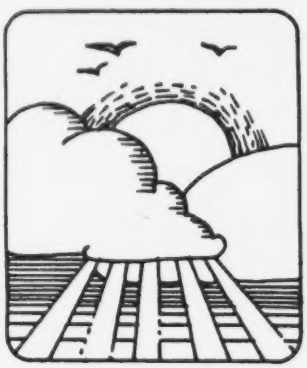
ACTIVITIES

1. Set up a record player in the room and provide a variety of sky records for the students to play during free time. For the first two weeks, regularly play music at a certain hour of the day. Early in the morning as the students are first coming to school or the last half hour of school are good times.
2. Have the students write sky stories, poems, or haiku inspired by a sky song.
3. Have the students illustrate a piece of music and then use these drawings to make record jackets.
4. Ask the students to make up new sky lyrics to a familiar song, using vocabulary from previous lessons or the Cloud Chart.
5. Bilingual students can teach the class sky songs in languages other than English.
6. Have the students compose their own instrumental or vocal pieces and teach them to the class.
7. As a class activity put on a play about the sky and include sky songs the students know. Sky paintings may be the backdrop.
8. Play a game of charades. The students are to guess the names of familiar sky songs.

Weatherwise and Otherwhys
By Bruce Schwoegler

Why do some clouds have flat bottoms?

Temperature, humidity and vertical air currents cause flat cloud bottoms and cauliflower tops. Rising, humid air forms a cloud when its water vapor condenses while crossing a colder temperature level in the sky. Motion beyond this tablelike surface is governed by turbulent air which sometimes bubbles cloud droplets tens of thousands of feet higher.



Sky Songs

Time of Day and Night
- "On a Wonderful Day like Today"
- "Oh, What a Beautiful Morning"
- "In the Cool, Cool, Cool of the Evening"
- "Zip-A-Dee-Do-Da"

Clouds
- "Look for the Silver Lining"
- "A Foggy Day in London Town"

Sky
- "Blue Skies"
- "Ole Buttermilk Sky"
- "America the Beautiful"

Rainbows
- "Somewhere Over the Rainbow"
- "There's a Rainbow 'Round My Shoulder"
- "Rainbow Connection"

Wind
- "Summer Wind"
- "Tumbling Tumbleweeds"
- "Breezin' Along with the Breeze"
- "They Call the Wind Mariah"
- "Blowin' in the Wind"
- "Wayward Wind"
- "Up, Up, and Away"

Moon
- "It's Only a Paper Moon"
- "Blue Moon"
- "Fly Me to the Moon"
- "Sail Along, Silv'ry Moon"
- "Shine On Harvest Moon"
- "Moon River"

Stars
- "When You Wish Upon a Star"
- "Twinkle, Twinkle, Little Star"
- "Good Morning Starshine"
- "The Star-Spangled Banner"
- "Catch a Falling Star"

Sun
- "Red Sails in the Sunset"
- "Let the Sunshine In"
- "On the Sunny Side of the Street"
- "Tomorrow"
- "Sunrise, Sunset"
- "Good Day Sunshine"
- "Canadian Sunset"

Recordings

(C)lassical, (P)opular, (F)olk

C Sunrise: Haydn: Quartet in B flat, Op. 76 #4
C Sunrise: Hovhaness: Sunrise
C Sunrise: Ives: New World 300 (Baritone and Piano)
C Sunrise: Sibelius: Night Ride and Sunrise, Op. 55
F Dawn: The Dawn Began to Glow
C Mussorgsky: Daybreak on the Moskva River
C Wagner: Dawn and Siegfried's Rhine Journey
F Ian and Sylvia: Early Morning Rain
F Burleigh, H.T.: My Lord, What a Mornin'
C Mahler: Songs of a Wayfarer
Symphony No. 1
Symphony No. 3, 5th Movement
What the Morning Bells Tell Me
C Dawn: Faure: L'Aurore
C Morning: Delius: Song Before Sunrise
F Tom Paxton: Gray Day
C VonSuppe, Franz: Morning Noon and Night in Vienna
C Roussakis, Nicolas: Ephemeris
P Rodgers, Richard: Oh, What a Beautiful Morning
C Rorem, Ned: Day Music
P Schwartz, Stephen: Pippin: Morning Glow
C Haydn: Symphony #7 in C "Le Midi"
F The Odessa Balalaikas: Evenings Near Moscow
F (Tahiti) Song for the Sea at Sunset
C Delius: Songs of Sunset
C Grieg: Evening in the Mountains, Lyric Pieces, Op. 68, Solo Piano
C Haydn: Symphony #8 in G "Le Soir"
C Respighi: The Sunset
F Schlaf Mein Kind: Rozhinkes mit Mandlen
C Crumb, George: Night of the Four Moons
C DeFalla: Nights in the Gardens of Spain
C Mussorgsky: Night on Bald Mountain
P Rodgers, Richard: It's a Grand Night for Singing
P Winston, George: Night
C Holst: The Planets
C Satie, Erik: Les Anges
P Auldridge, Mike: The World Is Waiting for the Sunrise
P Miller, Glen: Moonlight Serenade
P Miller, Glen: Sunrise Serenande
P Anderson, Leroy: Summer Skies: Eastman Pops
C Berlioz: The Nights of Summer, Op. 7

Appendix

Beaufort Wind Scale

Beaufort Number	Wind Description	Speed, mi/hr.	Criteria
0	calm	0	smoke rises vertically
1	light air	1-3	direction shown by smoke drift, but not by wind vanes
2	slight breeze	4-7	wind felt on face; leaves rustle; wind vane moved by wind
3	gentle breeze	8-12	leaves and small twigs in constant motion; wind extends light flag
4	moderate breeze	13-18	raises dust and loose paper; small branches are moved
5	fresh breeze	19-24	small trees in leaf begin to sway
6	strong breeze	25-31	large branches in motion; whistling heard in utility wires
7	moderate gale	32-38	whole trees in motion; inconvenience felt in walking against wind
8	fresh gale	39-46	break twigs off trees; generally impedes progress
9	strong gale	47-54	slight structural damage occurs; roof shingles blown free
10	whole gale	55-63	trees uprooted; considerable structural damage occurs
11	storm	64-75	widespread damage; very rarely experienced
12	hurricane	75+	extreme destruction

Setting Up Your School Weather Station

This is an activity that your class can work on by itself or in combination with the other "For Spacious Skies" classes in your school. Setting up a weather station will not only be fun for the students, but it will also provide unlimited educational opportunities.

EQUIPMENT

You can make a simple weather station to start and gradually add more instruments. The two basic elements that you should start with will be a thermometer and a rain gauge. You can also consider adding the following: hygrometer, barometer, anemometer, and a snowboard.

THERMOMETER: an instrument for measuring temperature.

There are many different types and brands of thermometers. The ideal thermometer for a school weather station would be a mercury, max/min thermometer. The max/min thermometer not only gives the current temperature but it also keeps the max/min reading until it is reset.

Where you place the thermometer will largely determine just how useful this instrument is to you. All official temperatures are taken in the shade, so you should find a shady location near your school preferably the Northeast side. The thermometer should be placed about 6 feet above the ground. Since this is well above eye level for most youngsters it will be a good idea to place a step nearby. The thermometer also needs a location with adequate ventilation. A few places you should avoid are balconies, patios, enclosed porches, and beneath eaves. You want the thermometer to reflect the air temperature and not the temperature of a building. Avoid placing your thermometer against a dark colored background; like painted shutters, or else your reading will be unusually high.

There is a very simple technique which you can use to calibrate your thermometer. This is not only a useful activity but is can also be a great learning experience for your students. Make an ice-water bath and then place the thermometer into this mixture of water and ice cubes for several minutes. The ice bath has a temperature of 32 degrees (O C) and so should your thermometer. If there's a small difference, then this value may be used to adjust your daily reading.

RAIN GAUGE: a device used to measure rainfall.

The key in placing your rain gauge is to avoid obstructions that may hinder the fall of precipitation. First, place the rain gauge on a level surface. Secondly, a good rule is to put the rain gauge at least twice the horizontal distances from the tallest object. If this is not possible, then place it in the widest space around. One hint to remember in the spring and fall is that many plastic rain gauges will crack if they are full and the temperature falls below freezing.

HYGROMETER: an instrument designed to measure the air's water vapor content.

The vast majority of hygrometers are made for indoor use and you should not use it outside unless it's designed to withstand harsh conditions.

Most hygrometers can be calibrated by placing a warm, wet towel or facecloth over it for a few minutes. Then check the hygrometer, it should read in excess of 95%, if not adjust the screw in the back to read at least 95%.

BAROMETER: an instrument that measures atmospheric pressure.

The barometer will function just as well indoors as outdoors. It's usually easier to place it inside but the actual location is not important.

All aneroid barometers have an adjustment screw in the back. First, get the latest barometric reading from a local weather station (within 50 miles). You can call your local weather service and ask for the weather department to get this information. Then adjust the set screw so the barometer reads as close as possible to the latest value. Don't be concerned about the exact reading or the effect of your elevation since it's the **changes** in pressure that are important in relation to weather changes.

ANEMOMETER: an instrument designed to measure wind speed.

In general, the accuracy of these instruments is directly related to their cost. For those of you that purchase a cup anemometer and wind vane, it's crucial that in placing this instrument you avoid all obstructions. The ideal height of an anemometer is 10 meters (30 ft.). Trees, building, houses, etc. should be avoided, especially in the direction from which the prevailing wind blows. The prevailing wind varies between southwest (230 degrees) and northwest (310 degrees) on a compass.

SNOWBOARD: a device used to measure snowfall accumulation.

This is one of the instruments that you can make yourself. You need a flat eighteen inch square platform and a 2 to 3 ft. rod. You'll want to mark the rod in half-inch increments. If you can't find a rod, a yardstick will also work. You'll want to fasten the rod or yardstick perpendicular to the platform. (Make sure that it is in the center of the platform). Now, you're ready to place the snowboard outside. You can make 2 snowboards, one to measure the snow depth and the other which is cleaned off daily to measure the snowfall.

When placing your snowboard outside, you should follow the same guidelines that you followed for the rain gauge.

PURCHASING TIPS:

The following are addresses of a few large weather instrument firms in the U.S. These are by no means the only ones, but this should help if you know of none:

Science Associates
230 Nassau Street
Box 230
Princeton, NJ 08540

Sybron/Taylor
Consumer Industrial Products
Arden, NC 28704

Bushnell Division
Bausch & Lomb
300 North Lone Hill Ave.
San Dimas, CA 91773
ATTN: Mr. George Atamian
1-800-423-3537

Heath Company
Benton Harbor, MI 49022

Edmund Scientific
101 E. Glouster Pike
Barringtron, NJ 08007

Wind & Weather
P.O. Box 2320
Mendocino, CA 95640

Weathermeasure/Weathertronics
P.O. Box 41039
Sacramento, CA 95841

You can also find thermometers and rain gauges in your local hardware of farm and home store.

TIPS FOR WEATHERSTATION ACTIVITIES:

Set up a schedule so that your students check the weatherstation and reset everything at the same time each day (preferably in the morning).

Have your students come up with a chart so that they can keep a daily record for their station. If the students are older they can also compute monthly averages (avg. high, avg. low, avg. temp.) and monthly precipitation totals. The students can compare their daily information with the statistics from your local city. These are given daily at the beginning of the weather segment during your local weathercast.

A lot of times there will be big changes from one day to the next. Have your students try to explain these changes. (i.e. cloudy vs sunny, windy vs calm).

Make sure that the students also note the sky conditions at the time of observation.

Another factor is the visibility. Can they see the house down the road? Was it raining or snowing at observation time and did that effect the visibility?

If your class builds two snowboards your students will not only be able to see the snowfall amounts from each storm, but they will also be able to note the snowcover on the 2nd board. The snow cover changes as snow settles, temperature flucuates, and the wind changes. Have your students note the daily snowcover along with the daily snowfall on their charts.

There are countless numbers of activities that can center around your new weatherstation. Your students will have a greater appreciation of the environment around them not to mention their work on organizational skills and math.

A Few Notes About Nightime Sky Awareness

Since your class does not meet at night it's hard to point out some of the beautiful things in the nightime sky. One activity you might try is to take a plastic cup or a can on the bottom of the container poke holes in the form of different constellations. The students can then take these home and try to find the constellation in the nightime sky. This activity will allow you to study the nightime sky during the day.

You might also check about getting a sky calendar for your class and letting them know when certain planets and stars are visible. These calendars are available from:

Abrams Planetarium Sky Calendar
Michigan State University
East Lansing, MI 48824

The cost for year's subscription is $6. These charts not only contain a day by day account of the nightime sky, but on the other side they show a chart of what the different constellations visible that month look like and where they can be found.

EXPERIMENTS AND PROJECTS

If you are interested in further information on experiments or projects you might check the following sources:

Laird, Charles and Ruth. Weathercasting: A Handbook of Amateur Meteorology. Englewood Cliffs, N.J. Prentice Hall, 1972 (12th Printing). A How-To Book useful in designing science fair projects of laboratory demonstrations at the elementary school level.

Trowbridge, Leslie W., Experiments in Meteorology: Investigation for the Amateur Scientist. New York: Doubleday, 1973. Outlines 31 basic experiments for studying clouds, humidity, rain, snow, storms, wind, lightning, and atmospheric composition. Each project includes a list of materials, complete instruction, and an explanation of the underlying theory, including essential mathematics when required.

Appendix

Wind-Barometer Table

The wind and barometer indications for the United States are generally summarized in the following table:

Wind Direction	Barometer Reduced to Sea Level	Character of Weather Indicated
SW to NW	30.10 to 30.20 and steady	Fair, with slight temperature changes for 1 to 2 days.
SW to NW	30.10 to 30.20 and rising rapidly	Fair, followed within 2 days by rain.
SW to NW	30.20 and above and stationary	Continued fair, with no decided temperature change.
SW to NW	30.20 and above and falling slowly	Slowly rising temperature and fair for 2 days.
S to SE	30.10 to 30.20 and falling slowly	Rain within 24 hours.
S to SE	30.10 to 30.20 and falling rapidly	Wind increasing in force, with rain within 12 to 24 hours.
SE to NE	30.10 to 30.20 and falling slowly	Rain in 12 to 18 hours.
SE to NE	30.10 to 30.20 and falling rapidly	Increasing wind, and rain within 12 hours.
E to NE	30.10 and above and falling slowly	In summer, with light winds, rain may not fall for several days. In winter, rain within 24 hours.
E to NE	30.10 and above and falling rapidly	In summer, rain probably within 12 to 24 hours. In winter rain or snow, with increasing winds, will often set in when the barometer begins to fall and the wind sets in from NE.
SE to NE	30.00 or below and falling slowly	Rain will continue 1 to 2 days.
SE to NE	30.00 or below and falling rapidly	Rain, with high wind, followed within 36 hours by clearing, and in winter by colder.
S to SW	30.00 or below and rising slowly	Clearing within a few hours, and fair for several days.
S to E	29.80 or below and falling rapidly	Severe storm imminent, followed within 24 hours by clearing and in winter by colder.
E to N	29.80 or below and falling rapidly	Severe northeast gale and heavy precipitation: in winter, heavy snow, followed by a cold wave.
Going to W	29.80 or below and rising rapidly	Clearing and colder.

Appendix

Relative Humidity

Difference Between Dry-Bulb and Wet-Bulb Readings

	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56
98	96	93	89	86	83	79	76	73	70	67	64	61	58	56
96	96	93	89	86	82	79	76	73	69	66	63	61	58	55
94	96	93	89	85	82	79	75	72	69	66	63	60	57	54
92	96	92	89	85	82	78	75	72	68	65	62	59	56	53
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52
88	96	92	88	85	81	77	74	70	67	64	61	57	54	51
86	96	92	88	84	81	77	73	70	66	63	60	57	53	50
84	96	92	88	84	80	76	73	69	66	62	59	56	52	49
82	96	92	88	84	80	76	72	69	65	61	58	55	51	48
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47
78	96	91	87	83	79	75	71	67	63	60	56	53	49	46
76	96	91	87	82	78	74	70	66	62	59	55	51	48	44
74	95	91	86	82	78	74	69	65	61	58	54	50	47	43
72	95	91	86	82	77	73	69	65	61	57	53	49	45	42
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40
68	95	90	85	80	76	71	67	62	58	54	50	46	42	38
66	95	90	85	80	75	71	66	61	57	53	48	44	40	36
64	95	90	84	79	74	70	65	60	56	51	47	43	38	34
62	94	89	84	79	74	69	64	59	54	50	45	41	36	32
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30
58	94	88	83	77	72	66	61	56	51	46	41	37	32	27
56	94	88	82	76	71	65	60	55	50	44	39	34	30	25
54	94	88	82	76	70	64	59	53	48	42	37	32	27	22
52	94	87	81	75	69	63	57	51	46	40	35	29	24	19
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16
48	93	86	79	73	66	60	54	47	41	35	29	23	18	12
46	93	86	79	72	65	58	52	45	39	32	26	20	14	8
44	93	85	78	71	63	56	49	43	36	30	23	16	10	4
42	92	85	77	69	62	55	47	40	33	26	19	12	5	
40	92	83	75	68	60	52	45	37	29	22	15	7	0	

Relative Humidity

EXAMPLE: Read dry bulb thermometer. Record the reading. (example, 68°) Wrap the thermometer bulb with cotton cloth and tie with string. Wet the cotton cloth.
Spin or wave the thermometer for about 15 seconds.
Record the wet bulb reading. (example, 55°)
Subtract the wet bulb reading from the dry bulb reading. (example, 13°)
Read across the 68° row, down the 13° row. Where the two rows meet, relative humidity is found.

Dry-Bulb Reading (°F)

Appendix

Conversion Table

°Fahrenheit to °Celsius

Temperature °F	°F	Temp. °C	Temperature °F	°F	Temp. °C
- 22.8 to	- 21.1	- 30	+ 50.9 to	+ 52.6	+11
- 21.0	- 19.3	- 29	+ 52.7	54.4	12
- 19.2	- 17.5	- 28	54.5	56.2	13
- 17.4	- 15.7	- 27	56.3	58.0	14
- 15.6	- 13.9	- 26	58.1	59.8	15
- 13.8	- 12.1	- 25			
- 12.0 to	- 10.3	- 24	+ 59.9 to	+ 61.6	+16
- 10.2	- 8.5	- 23	61.7	63.4	17
- 8.4	- 6.7	- 22	63.5	65.2	18
- 6.6	- 4.9	- 21	65.3	67.0	19
- 4.8	- 3.1	- 20	67.1	68.8	20
- 3.0 to	- 1.3	- 19	+ 68.9 to	+ 70.6	+21
- 1.2	+ 0.5	- 18	70.7	72.4	22
+ 0.6	+ 2.3	- 17	72.5	74.2	23
+ 2.4	+ 4.1	- 16	74.3	76.0	24
+ 4.2	+ 5.9	- 15	76.1	77.8	25
+ 6.0 to	+ 7.7	- 14	+ 77.9 to	+ 79.6	+26
+ 7.8	+ 9.5	- 13	79.7	81.4	27
+ 9.6	+11.3	- 12	81.5	83.2	28
+11.4	+13.1	- 11	83.3	85.0	29
+13.2	+14.9	- 10	85.1	86.8	30
+15.0 to	+16.7	- 9	+ 86.9 to	+ 88.6	+31
16.8	18.5	- 8	88.7	90.4	32
18.6	20.3	- 7	90.5	92.2	33
20.4	22.1	- 6	92.3	94.0	34
22.2	23.9	- 5	94.1	95.8	35
+24.0 to	+25.7	- 4	+ 95.9 to	+ 97.6	+36
25.8	27.5	- 3	97.7	99.4	37
27.6	29.3	- 2	99.5	101.2	38
29.4	31.1	- 1	101.3	103.0	39
31.2	32.8	0	103.1	104.8	40
+32.9 to	+34.6	+ 1	+104.9 to	+106.6	+41
34.7	36.4	2	106.7	108.4	42
36.5	38.2	3	108.5	110.2	43
38.3	40.0	4	110.3	112.0	44
40.1	41.8	5	112.1	113.8	45
+41.9 to	+43.6	+ 6	+113.9 to	+115.6	+46
43.7	45.5	7	115.7	117.4	47
45.5	47.2	8	117.5	119.2	48
47.3	49.0	9	119.3	121.0	49
49.1	50.8	10	121.1	122.8	50

Appendix

Wind Chill Table
(Equivalent Temperature)

	Wind Speed							
	5MPH	**10MPH**	**15MPH**	**20MPH**	**25MPH**	**30MPH**	**35MPH**	**40MPH**
35	33	21	16	12	7	5	3	1
34	32	20	15	10	6	4	2	0
33	31	19	14	8	4	2	0	-1
32	29	18	13	7	3	1	-1	-2
31	28	17	12	5	1	-1	-3	-3
30	27	16	11	3	0	-2	-4	-4
29	26	15	9	2	-1	-4	-6	-6
28	25	13	7	0	-3	-6	-8	-8
27	23	12	5	-1	-4	-7	-9	-10
26	22	10	3	-3	-6	-9	-11	-13
25	21	9	1	-4	-7	-11	-13	-15
24	20	8	0	-5	-9	-12	-14	-16
23	19	6	-2	-6	-10	-14	-16	-18
22	18	5	-3	-7	-12	-15	-17	-19
21	17	3	-5	-8	-13	-17	-19	-21
20	16	2	-6	-9	-15	-18	-20	-22
19	15	1	-7	-11	-16	-20	-21	-23
18	14	0	-8	-12	-18	-21	-23	-25
17	14	0	-9	-14	-19	-23	-24	-26
16	13	-1	-10	-15	-21	-24	-26	-28
15	12	-2	-11	-17	-22	-26	-27	-29
14	11	-3	-12	-18	-23	-27	-29	-30
13	10	-5	-14	-20	-25	-29	-30	-32
12	9	-6	-15	-21	-26	-30	-32	-33
11	8	-8	-17	-23	-28	-32	-33	-35
10	7	-9	-18	-24	-29	-33	-35	-36
9	6	-10	-19	-26	-31	-35	-37	-38
8	5	-11	-21	-27	-32	-36	-38	-40
7	3	-13	-22	-29	-34	-38	-40	-41
6	2	-14	-24	-30	-35	-39	-41	-43
5	1	-15	-25	-32	-37	-41	-43	-45
4	0	-16	-27	-34	-39	-43	-45	-47
3	-2	-18	-28	-35	-40	-44	-47	-49
2	-3	-19	-30	-37	-42	-46	-48	-50
1	-5	-21	-31	-38	-43	-47	-50	-52
0	-6	-22	-33	-40	-45	-49	-52	-54
-1	-7	-23	-34	-41	-46	-50	-54	-56
-2	-8	-24	-36	-42	-48	-52	-55	-57
-3	-9	-25	-37	-44	-49	-53	-57	-59
-4	-10	-26	-39	-45	-51	-55	-58	-60
-5	-11	-27	-40	-46	-52	-56	-60	-62
-6	-12	-28	-41	-47	-53	-57	-61	-63
-7	-13	-29	-42	-48	-54	-59	-63	-65
-8	-13	-29	-43	-50	-56	-60	-64	-66
-9	-14	-30	-44	-51	-57	-62	-66	-68
-10	-15	-31	-45	-52	-58	-63	-67	-69

To find out how cold it feels outside (equivalent temperature) compare the actual air temperature (column on left) with the wind speed.

Actual Air Temperature (°F)

Appendix

CONVERSION FACTORS

To convert from	To	Multiply by
Length		
centimeters (cm)	inches	0.394
feet (ft)	centimeters	30.5
inches (in)	centimeters	2.54
kilometers (km)	miles	0.621
meters (m)	feet	3.28
meters (m)	yards	1.094
miles (mi)	kilometers	1.609
millimeters (mm)	inches	0.0394
yards (yd)	meters	0.914
Area		
acres	hectares	0.405
acres	sq. meters	4047
hectares (ha)	acres	2.47
sq. centimeters (cm^2)	sq. inches	0.155
sq. feet (ft^2)	sq. meters	0.0929
sq. inches (in^2)	sq. centimeters	6.45
sq. kilometers (km^2)	sq. miles	0.386
sq. meters (m^2)	sq. yards	1.196
sq. meters (m^2)	sq. feet	10.76
sq. yards (yd^2)	sq. meters	0.836
Volume		
cubic centimeters (cm^3)	cubic inches	0.0610
cubic feet (ft^3)	cubic meters	0.0283
cubic inches (in^3)	cubic centimeters	16.39
cubic meters (m^3)	cubic feet	35.3
cubic meters (m^3)	cubic yards	1.308
cubic yards (yd^3)	cubic meters	0.765
gallons (gal)	liters	3.79
liters (l)	quarts, U.S.	1.057
milliliters (ml)	ounces	0.0338
quarts, U.S. (qt)	liters	0.946
Mass		
grams (g)	ounces, avdp.	0.0353
kilograms (kg)	pounds	2.205
ounces, avdp. (oz)	grams	28.3

Recommended Reading

Atamian, George C. *Naked Eye to Deep Sky, A Self-Instruction Guide for Neophytes Who Want to Learn More about the Heavens.* Bausch & Lomb, 1985.

Borden, Jack. "For Spacious Skies, a National Effort to Increase Sky Awareness." Sky Interpretation Resource Bulletin, Vol. IV 1980.

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Duhl, Leonard J. "Health and the Inner and Outer Sky." Paper presented at For Spacious Skies Conference on the Sky, Grand Canyon National Park, Arizona, May 30-June 1, 1981.

Gregory, R.L. *Eye and Brain, The Psychology of Seeing.* McGraw-Hill, 1970.

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National Park Service, U.S. Department of the Interior. " 'My Eyes Need a Good Stretching' — Seven Authorities Speak Out on Visibility, Clean Air and Unique Natural Areas," U.S. Government Printing Office, 1978. (782-127)

OBIS (Outdoor Biology Instructional Strategies) Modules. "Cool It" and "Terrestrial Hi-Lo Hunt." For copies contact: Delta Education, Box M, Nashua, NH 03061.

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Roth, Charles E. "Observing Nature, Basic Techniques of Science and Art." Paper presented to the American Nature Study Society, Dec. 27, 1963.

Roth, Charles E. "Education of Sky Beings." Paper presented at For Spacious Skies Conference on the Sky, Grand Canyon National Park, Arizona, May 30-June 1, 1981. For reprints of Roth papers contact: Charles Roth, c/o Massachusetts Audubon Society, Lincoln, MA 01773.

Roth, Charles E. *Sky Observer's Guide Book.* Prentice-Hall, 1986. Forward by Jack Borden, Founder of "For Spacious Skies." Available from "For Spacious Skies."

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Sloane, Eric. *Look at the Sky*. Duel Sloane & Pearce, 1961.

Whitney, Charles A. *Whitney's Star Finder*. Alfred A. Knopf, 1985.

Wood, Elizabeth A. *Science from Your Airplane Window*. Dover, 1975.

Zube, Ervin H., Charles Law, and Eugene Trobia. "Perceptions of Sky as Object, Background, Information Source and Symbol." Paper presented at For Spacious Skies Conference on the Sky, Grand Canyon National Park, Arizona, May 30-June 1, 1981.

For reprints of For Spacious Skies Conference papers, contact: For Spacious Skies, 54 Webb St., Lexington, MA 02173.

Periodicals

American Weather Observer, 401 Whitney Blvd., Belvidere, IL 61008 (monthly)
Weatherwise, 4000 Albemarle St., NW, Washington, DC 20016 (bimonthly)
Sky & Telescope, 49 Bay State Rd., Cambridge, MA 02238 (monthly)

Television

Weather Channel, 2840 Mt. Wilkinson Pkwy., Atlanta, GA 30339. 24-hour weather service with frequent local updates. Consult your local cable service.

KITS

Sky Watcher's Weather Set by Bushnell Division, Bausch & Lomb Corp. Approved & recommended by For Spacious Skies.
For more information contact:
For Spacious Skies
54 Webb St.
Lexington, MA 02173

OBSERVATION SHEET FOR SPACIOUS SKIES

name _____ school _____

Date	Day	Today's Temp°	Wind coming from (Direction)	Warmer or colder than yesterday	Cloud shapes and colors	Today's rain or snow amount	Describe how you feel today
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

FOR SPACIOUS SKIES

Date	Day	Today's Temp°	Wind coming from (Direction)	Warmer or colder than yesterday	Cloud shapes and colors	Today's rain or snow amount	Describe how you feel today
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Permission granted to duplicate these sheets from For Spacious Skies.

Please Cut Along This Line

FOR SPACIOUS SKIES
Reponse Form

Name _____ Phone _____

School Address _____

_____

Grade Level _____ Number of Students _____

Would you like to be on the For Spacious Skies mailing list? ___ Yes ___ No

How many minutes per week did you use For Spacious Skies activities? ____

Into which subject(s) did you incorporate For Spacious Skies activities?

_____

_____

What was the response from your students about For Spacious Skies?

_____

_____

Did you *generate* any additional materials or activities?
Please list and give sources.

_____

_____

Which activities did you like best? Why?

_____

_____

Which activities did you like least? Why?

_____

_____

What would you suggest to improve the materials?

_____

_____

How did you hear about "For Spacious Skies"?

_____

_____

Please mail this completed form to:

For Spacious Skies
54 Webb St.
Lexington, MA 02173

American Meteorological Society

The

Award for Outstanding Services to Meteorology by a Corporation

is conferred upon

For Spacious Skies Foundation

for fostering awareness and appreciation of the sky, and for promoting innovative school and public educational programs, based on awareness of the sky, which involve unique cooperations between school educators and broadcast meteorologists.

American Meteorological Society

January 1987

President

KDKA-TV'S Brian Susman and Southmoreland elementary teacher Terri Brewer show some first graders at Alverton Elementary School how to make "clouds." The station was at the school yesterday filming a segment for its "For Spacious Skies" program.

Independent-Observer photo

Local elementary students filmed for KDKA-TV segment

A Southmoreland elementary teacher and her first grade class have been selected to participate in an educational program in cooperation with KDKA Television in Pittsburgh.

Terri Brewer of Alverton Elementary School and her class were videotaped yesterday for a series on the "For Spacious Skies" program. The program is being conducted primarily in cooperation with KDKA-TV 2 weatherman Brian Susman.

Susman and cameraman Paul Spradley from KDKA were at Alverton Elementary School yesterday to film a segment for the series, which is scheduled to air the week of Nov. 16.

The FSS program was developed by Boston meteorologist Jack Borden. According to Susman, the program — designed to increase awareness of the sky above us — has done much more than that. "A Harvard study indicated there was an increase in literary skills of 12 percent and visual arts skills by five percent for those children participating in the program," Susman said.

Borden designed the program to include students ranging from kindergarten to sixth grade. Susman said he likes the program because it includes activities which help increase literary skills, as well as covering math, science and several other subjects.

KDKA contacted Bob Baldis of the Pennsylvania State Education Association's Pittsburgh office and asked that his organization select four teachers from the KDKA viewing area to be included in the project. Brewer is the only teacher from Westmoreland County who was selected.

Although Baldis was unavailable for comment, a representative of his office explained that Brewer's selection was the result of "an internal union procedure."

Brewer isn't exactly sure why she was one of the four teachers selected, but she readily admits that she is excited about appearing on television for the second time in less than four months.

Back on July 31, Brewer appeared on WTAE-TV in a segment where she took over for feature reporter Lynn Cullen for a day. In that instance, Brewer entered a contest seeking an opportunity to appear on television. In this case, however, representatives from KDKA approached her about participating in a program geared toward education.

That fact, plus featuring her students on television, has Brewer looking forward to mid-November when the program airs.

"I'm really excited about it. This program puts children more in tune with their environment," Brewer added that FSS "increases

(Continued on page 14)

KDKA-TV segment

(Continued from page 1)

vocabulary and sight-word vocabulary," along with helping to develop several other skills.

KDKA's Dane Topich explained that the four teachers selected will participate in a "pilot" presentation to help explain the FSS program. He said that the segments will be videotaped so that teachers in the KDKA viewing area can learn about the FSS program.

Topich said Susman went to Boston to obtain more information on the FSS project. "For KDKA, this is an ongoing program participate with various schools. We realize that teachers are always looking for fresh, new ideas for their classrooms."

When it comes to various educational uses, Susman says of the project, "The sky's the limit. So many times we don't bother to look up at the sky and appreciate it. It's something beautiful and free."

Susman says the sky is a perfect medium for learning. He says the For Spacious Skies project is a six-unit curriculum "designed to help in all aspects of learning."

As far as KDKA is concerned, it is also a valuable public relations tool. "I'm excited about it," Susman said. "It's a great handshake with the community."

Shaking hands with KDKA is something Brewer believes will reflect positively on Southmoreland School District. "It's good to see our school district in such a positive way. There's a certain pride involved."

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"All the News That's Fit to Print"

The New York Times

New York: Today cloudy, rain likely. High 72-77. Tonight and tomorrow, cloudy, damp, thundershowers. Highs 75-80, lows 64-68. Yesterday: High 96, low 74. Details on page [illegible]

VOL. CXXXVI . . . No. 47,177 NEW YORK, SUNDAY, JUNE 21, 1987 $1.[illegible]

Seeing the Sky: Not a Limit but Infinity

By MATTHEW L. WALD
Special to The New York Times

BOSTON, June 20 — Jack Borden has an idea for motivating inner-city schoolchildren, residents of nursing homes, even prisoners: Look up at the sky.

Mr. Borden is a full-time proponent of a philosophy for education and thinking that he calls "sky awareness."

When he explains the idea to teachers, administrators, lawmakers and government officials, they ask him about the program, its curriculum, texts and teaching materials.

But it is really simpler than that. Many of life's problems could be solved, he says, if everyone took advantage of an untapped esthetic resource, by just looking up.

Cost Is An Advantage

"How many people who appreciate the beauty of the sky will ever mug a 7-Eleven cashier?" he asked in the emphatic, vaguely liturgical tone that is his standard speaking voice in describing the concept. "They might embezzle money, but not trash the head of a convenience store clerk."

The value of sky awareness as a crime stopper is undemonstrated, but Mr. Borden's nonprofit organization, For Spacious Skies, has spread the program to schools as far away as St. Louis and Lubbock, Tex. Perhaps in part because of the cost, it has proved popular with elected officials, too. Gov. Michael S. Dukakis declared March 18 For Spacious Skies Day.

Mr. Borden's almost poetic vision, and his conviction that we waste our powers by ignoring nature and looking down, came to him 10 years ago, when he was a reporter at a local television station, WBZ.

One day he stopped dozens of people on a Boston street and asked them, without looking up, to describe the sky. Only one in 10 could do so.

A Study by Harvard

What that loss of awareness means is not clear. But what it means to get it back was measured last year by Harvard University's Graduate School of Education. Researchers tested pupils at elementary schools in Needham who participated in For Spacious Skies in the fall of 1985 and again at the end of that school year, comparing them with other pupils who were not encouraged to look at the sky.

The researchers found that the emphasis on looking up, followed by drawing pictures and writing about the sky, "significantly increased the level of aesthetic sensitivity in visual art and literature."

"The benefits gained from a program such as this would have great value in any school curriculum," the study said.

It fits in well at the Josiah Quincy elementary school in Boston, which is wedged between Chinatown and the Massachusetts Turnpike and serves a student population heavy with children from homes where English is not spoken, or where the emphasis on education is not strong.

'A Whole New World'

"It opens up a whole new world," said Pat Keohane, whose class of first graders lined up eagerly Friday morning to point a low-power telescope at the clouds, and at the reflections of clouds off the windows of a nearby skyscraper. The 25 children, 6 to 8 years old, spotted all manner of creatures, real and fanciful, in the clouds, and then they rushed inside to put their observations on paper, graphically and verbally.

"I saw a spoon — it was so beautiful out today," wrote Tacquice Scott, 7, who then drew a spoon-shaped cloud. According to Miss Keohane, Tacquice's first full sentences were about the sky.

Nearby, Chon Hua, 6, whose parents came to Boston from Hong Kong and do not speak English, said he had seen a fish and an angel. He sat intently, drawing both, along with an airplane piercing a cloud. In fact, everyone in the room worked on the drawings with barely a fuss or a fidget for 20 minutes, which at the first-grade level constitutes an eternity.

"You tell them to write about a pet, and, well, maybe they don't have a pet," said Miss Keohane. "But everyone has the sky."

A Building That Changes

So does the principal, Charles Gibbons. Many days when he greets the school buses he tells the children to look at the glass facade of the nearby John Hancock building. "Every single day it's different," said Mr. Gibbons, who clearly enjoys the view.

For Spacious Skies, he said, is "a way to motivate teachers, to be able to get excited about something. Then to find out it's science is frosting on the cake."

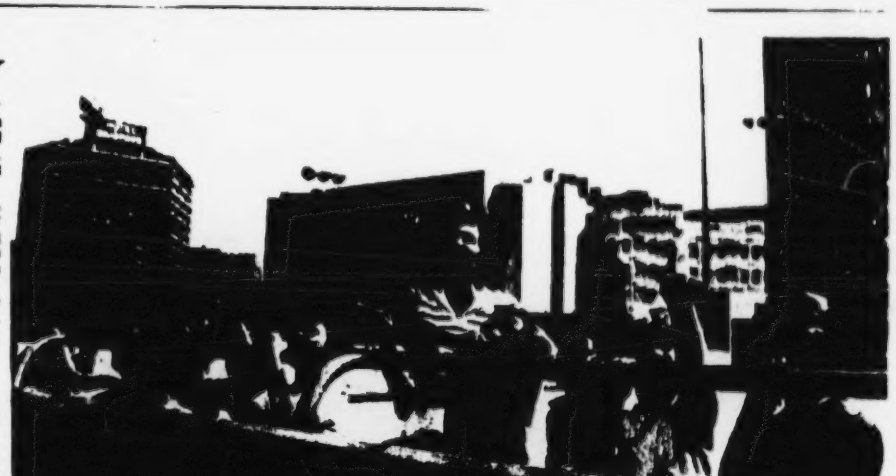
The idea also makes state legislators enthusiastic. Earlier this week the Education Committee of the Massachusetts House of Representatives heard Mr. Borden, administrators and pupils from two participating schools. The panel listened carefully to two fifth graders from the Hillside Elementary School in Needham.

"With my Christmas money, I went out and bought a camera, because I thought it was, like, so awesome," said Luke Hale, 11 years old.

Katie Massela, also 11, described the clouds as "like looking at layers of marshmallows." Before the program started, she said, "I really wasn't into it that much. When I drew pictures I just drew blue. Now I draw things I could never have drawn before."

Sky awareness is a full-time job for the 58-year-old Mr. Borden. He said the concept had been popular with residents of nursing homes but that an even more logical place would be overcrowded prisons, "where there's plenty of vertical space and not much horizontal space."

He has tried the idea on prison administrators, he said, but "they don't seem to know what I'm talking about."



The New York Times/Jon Brenneis

First-graders at Josiah Quincy elementary school in Boston with their teacher, Pat Keohane, learning about sky watching. "It opens up a whole new world," Miss Keohane said of the course.

The New York Times

Students from Miss Keohane's class observing the sky.

ANSEL ADAMS

ROUTE 1, BOX 181, CARMEL, CALIFORNIA 93923 TELEPHONE (408) 624-2558

January 20, 1981

Russell E. Dickenson, Jack Borden and Jerry Wishnow
For Spacious Skies
15 State Street
Boston, MA 02109

Gentlemen:

I am delighted to serve on the Board of For Spacious Skies. I join you with the deep concern for the quality of our air, both its' breathability and its' visibility.

I am appalled to look out over the ocean and see the pall of smog hugging the waves. I am appalled to see multi-colored air rolling down the mountains and covering even our rather isolated area.

Our sky, above each human, is our window on our universe, our passageway through dream and vehicle to the stars. Our air is changing from a crystalline vision to a distorting lens. How sad, and so much more so for our children and grandchildren. It does seem we have taken our living canopy of air for granted and we are killing it.

This is a marvelous project and one which I am extremely proud to be even a small part of.

Cordially,

Ansel Adams

AA/ma

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Fifth-graders in Northern California look to a heavenly muse: "Children who respond to this write in a profound way" REGINALD A. PEARMAN

When the Sky's the Limit

Grade schoolers gaze upward for lessons and inspiration

Life is like a room. You learn math, a door opens in your room. Now you can enter another room. Yet, I dislike rooms. I like to be free outside, and now I am. For the door to the sky was opened for me.

—Drew Prairie, 10, Vista Grande School, Danville, Calif.

For grade schoolers all across the country, the sky has begun to poke its way into the classroom. At Boston's Josiah Quincy School, Pat Keohane's first-graders play an animated game of hangman, filling in seven blanks that form the word cumulus. In Pittsburgh local Meteorologist Brian Sussman creates miniplanetariums for fifth-graders by piercing the shape of the Big Dipper on the bottom of plastic cups. In a fifth-grade classroom at the Hillside School in Needham, Mass., students think up celestial similes: trees become the "roots of the sky"; sunlight is "butter pouring through a hole"; clouds are savored as "marshmallows." When children look skyward for lessons and inspiration, all sorts of wonderful things happen, says Keohane. "It makes them think, expand their vocabulary, gain confidence. And the best part is that it's free."

Using the sky as a focal point for education is the brainchild of a retired Boston newscaster, Jack Borden. Ten years ago, while hiking, Borden gazed up and felt the jolt of an epiphany. "I had never really noticed the sky before," he recalls, "and its beauty, majesty and fragility just overpowered me." Expose children to this great expanse, he reasoned, and you have a thematic catalyst that spans the three Rs, encompasses the arts and sciences and engages the mind in a voyage of self-discovery. Borden, now 59, decided to take his inspiration to local schools. By 1984 he had founded a nonprofit organization called For Spacious Skies and had begun publishing a 32-page guide for teachers, outlining ways in which the sky can stimulate learning. Since then, 17,000 copies have been scooped up, and "sky awareness" has entered curriculums in school districts from Lubbock, Texas, to Wausau, Wis.

Because the teaching guide is no more than a sketchy starting point, For Spacious Skies programs vary greatly from school to school. At suburban Hillside, for example, students listen to "sky music" ranging from Franz Josef Haydn's *Sunrise Quartet* to Tom Paxton's *Even a Gray Day*. In Pittsburgh's Martin Luther King Jr. Elementary School, Ruth Martin's fifth-graders write cloud-inspired haiku and use star charts to find constellations. The program seems to work as well in cities as in suburbia: Martin describes an eight-year-old "barely able to contain his excitement" at having spotted Jupiter above the urban skyline with his naked eye.

At the Harvard Graduate School of Education, researchers have tried to evaluate the impact of For Spacious Skies programs on elementary school students. Using specially developed tests, researchers concluded that the artistic, musical and literary skills of students exposed to the programs improved much faster than did those of nonparticipating youngsters. Skies students scored 37% higher in music appreciation, 13% higher in literary skills and 5% higher in sensitivity to art. "Something happened to these kids," marvels Market Researcher Anton Morton, who helped analyze the results. "They learned much more and grew much more."

At a time when there is a great deal of lamentation about the decline in writing skills among American children, the program seems to be a beacon of hope. "Children who respond to this write in a profound way," observes Miriam Kronish, the principal at Hillside. Best of all, "it's fun," says a Hillside fifth-grader and budding poet, Elizabeth Stone. "You can write what you want," she points out, and unlike too many other assignments, "you understand what you are writing about." —*By Joelle Attinger/Boston*

Spacious Skies

I was delighted with the article reporting on how children can improve certain skills by gazing at the sky [EDUCATION, Feb. 29]. My father was a sky watcher and taught us to enjoy the stars. On cold Wyoming nights we'd stand amazed at the beauty of the night sky. In summer we would sprawl in the grass and imagine pictures in the clouds. I passed on that heritage to my children, and was pleased to hear my four-year-old granddaughter suggest to her mother, "Let's lie on the car hood and watch the stars." I agree that the sky encourages creativity, imagination and appreciation of one's place in this beautiful world.

Roseanna Johnson
Jayton, Texas

TIME
THE WEEKLY NEWSMAGAZINE

FEBRUARY 29, 1988

FOR SPACIOUS SKIES
c/o Jack Borden
54 Webb St.
Lexington, Mass. 02173

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FOR SPACIOUS SKIES
c/o Jack Borden
54 Webb St.
Lexington, MA 02173

The New York Times

Education Life

Section 12/January 3, 1988

7 Blackboard Notes

LIMITED OFFER--FSS ACTIVITY GUIDE plus FULL COLOR CLOUD CHART--$9.00--postpaid.

(Guide alone is $8.50 ppd and Chart alone is $3.00 ppd)

"Kit" means Guide

The Sky As a Tool For Learning

TO TRADITIONAL educators, the For Spacious Skies program might seem like castles in the air. But for Katie Masselam, a sixth-grader at the Pollard Middle School in Needham, Mass., the program was a new way of seeing — and speaking, writing and drawing about the world around her.

For Spacious Skies, a teaching kit devised and distributed to schools by Jack Borden, a former television reporter in Boston, is taking the schools by storm. Word of the kits is being spread not only by teachers but also by television weathermen throughout the nation, who occasionally mention the program during their broadcasts.

Last year, when Katie was in the fifth grade, her class used sky observation, helped by forms provided in the kit, to practice skills in language, science and creative arts. "I see more things now and hear and feel more things," she says. "The sky helps you wonder about them."

The kits, which are mailed to schools for as little as $7.50, include guides for teachers on presenting the material. The kits contain tables of wind-chill factors, relative humidity and barometric pressure; songs about the sky, and sample observation sheets for students to note weather conditions.

Mr. Borden, who works out of his home in Lexington, Mass., estimates that 14,000 classrooms now use For Spacious Skies, including three in New York City. His idea was to devise an interdisciplinary approach to education that aims to teach children to see the sky as a limitless source of imagination and inspiration. He began developing the program 10 years ago; it was first used in 1982 in Arlington, Mass., a Boston suburb.

Nathan Boyer painting a sunrise in Arlington, Mass.

Barbara Aliprantis, a storyteller at the St. Joseph School for the deaf in the Bronx, uses sky stories, pictures and books to help foster language development in children. She agreed that For Spacious Skies had aided her work "I just feel there's a freedom that's happening," she said. "We're being much more whimsical, more creative."

Judith Warner

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The journal devoted to preschool through middle school science teaching

Science and Children

March 1983
Volume 20 • Number 6

The Sky's the Limit

Lois Slavin

The sky has been a source of information for travelers, farmers, sailors, and explorers forever; but how many of the rest of us actually use the sky in our everyday lives? Do you ever check the sky and make your own weather forecast? Or do you tune in to your local TV weather report instead? Can you even describe what the sky looked like the last time you were outdoors?

According to Ervin Zube of the University of Arizona, most people are peculiarly unaware of the sky. One of our greatest educational resources is just not being used.

"The sky is so much with us, so much a backdrop for daily events, that we habituate ourselves to it and let it become only a faintly perceived background to our lives," says Charles Roth, educator and naturalist at the Massachusetts Audubon Society in Lincoln. "Given its central role in shaping many aspects of our existence, this can be a sad mistake. But the educational process can help give the sky a more prominent spot in our daily lives. The sky is a valuable educational tool. . . . It permits direct contact with a key aspect of our environment and can be explored for temperature, pressure, smell, color, and transported objects. . . . It can be used as a resource with a number of different subjects in the school curriculum if only the teacher is educated to see the opportunities."

Zube and Roth made these statements in the Grand Canyon at a 1981 conference sponsored by the For Spacious Skies organization. FSS wor-

Lois Slavin is an instructor in the Mass Communications Department, Emerson College, Boston, Massachusetts, and a freelance writer. Photographs by Michael Nagy. For further informa-

For further information
write: FOR SPACIOUS SKIES
3 JOY ST.
BOSTON, MA 02108

increase sky awareness throughout the country; and the Sky Awareness Project in the Arlington, Massachusetts, public school district is one example of this effort.

Mass Awareness

The Sky Awareness Project was designed by Henry Robinson and Ken Arnold, codirectors of the district's Science Center, and FSS founder Jack Borden. When they started work on the project, they found virtually no materials for teaching sky awareness, and most of what was available pertained to weather and constellations. "It seemed," says Robinson, "the sky had been taken for granted as an educational tool, and its use in the classroom was not approaching its potential. But this freed us quite a bit in designing our own materials."

At first, creating a sky curriculum presented certain problems. "The sky is an amorphous subject. You can't study it by grabbing it and putting it in a test tube," says Arnold. "And it relates to so many disciplines—it was difficult to know where to start."

So, after much discussion, they decided to incorporate sky awareness into as many different subjects as they could. Two outdoor education specialists, Janet Anderson and Walter Kittredge, were brought in, and the group gathered sky materials relating to science, math, history, astronomy, religion, mythology, photography, and literature—what they called the *whole view*. Then, Anderson and Kittredge began visiting selected classes, grades one through twelve, on a regular basis.

"We tried to integrate sky awareness with what the teachers were already doing," says Anderson. "For example, in a math class, we asked the students to figure out a sky problem, like how long it would take the light from the Sun to reach the Earth."

"We also took the kids outside," adds Kittredge, "and had them outline their shadows with chalk on the playground. Later, we used the shadows to show them how the Earth rotates.* In a history class, we looked at the role the sky played in ancient Greece. And in an art class, we tried to get the students to look at certain paintings and see the sky as an object, not just a background."

Look Up at the Sky!

Both Anderson and Kittredge feel sky awareness is easy to teach for many reasons. The sky is always available—day or night, rain or shine. And it is free.

What's more, sky awareness lends itself to both traditional and nontraditional approaches, and few supplies are needed. A teacher can do a lesson on the atmosphere and then take students outside, where they can observe the mass of air that surrounds the Earth for themselves. Painting assignments can be added to the lesson, or younger students can be asked to do a sky dance, moving according to "how the sky makes them feel."

Sky awareness can be adapted to any level of any discipline and simplified or made more sophisticated, depending on the teacher's inclination, the facilities, and the time available. There is no one way to do it. Anderson and Kittredge are reluctant to give step-by-step directions on how to help students perceive what they call the *whole view*. They feel that doing so would lessen the personal awareness necessary if teachers are to stimulate students and help them see and appreciate the sky from their own points of view.

A general idea, however, can be given by extending the atmosphere lesson mentioned earlier. When Kittredge and Anderson took the children outside, they asked them to do a sky check, to look at what the sky was doing right at that moment. One student saw a cat in the clouds; another found the number nine. Some students took photos, using Polaroid's OneStep cameras.** Later, their teacher used these photos in the classroom, to explain cloud identification and to stimulate activities in writing, art, and public speaking.

Arnold reemphasizes that, while special equipment is helpful, it is not essential. "What is imperative is sky awareness on the part of the teacher and the students. Sky awareness can be stimulated and developed by something as simple as taking your students outside for five minutes every day and asking them to look at the sky, or as sophisticated as asking them to take a picture with a OneStep and asking them later to compare the picture with what they think they saw. The important thing, however, is to develop that awareness."

*For more shadow activities, see "Science with Shadows" in the February 1982 issue of *S&C*.

**The Sky Awareness Project received generous support from three corporate groups: the Polaroid Education Project, which donated OneStep cameras; Houghton Mifflin, which provided copies of Peterson's *Field Guide to the Atmosphere*; and Bausch and Lomb, which donated high-quality protective sunglasses.

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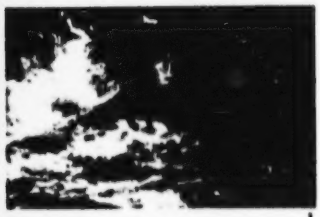
Predominating clouds in a formation determine code number and classification. The caption forecasts appearing below are based on surface wind directions.

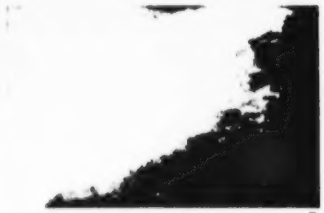
Cloud C

THIS CHART HAS BEEN PREPARED TO AID IN THE INTERPRETATION OF CLOU



1

H1—CIRRUS fibratus
Ice clouds. Good weather if winds from W NW to N. Precipitation likely within 20 to 30 hours if winds steady from NE E to S.

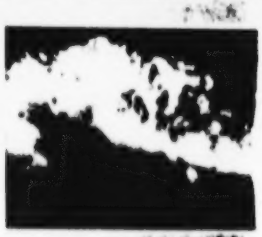


2

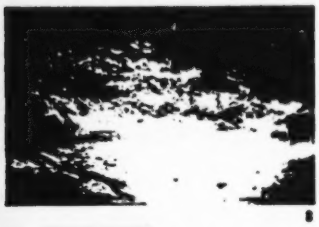
H3—CIRRUS spissatus
Ice clouds. Good weather if winds from W NW to N. Precipitation likely within 20 to 30 hours if winds steady from NE E to S.

3

H4—CIRRUS uncinus spreading over sky
High ice clouds. Good weather if winds from W NW to N. Precipitation likely within 20 to 30 hours if winds steady from NE E to S.



H6—CIRRUS above 45°
High ice clouds. Good weather if w
W NW to N. Precipitation likely wi
30 hours if winds steady from NE E



8

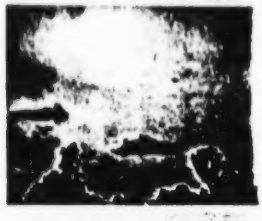
H9—CIRROCUMULUS
Ice clouds. Precipitation likely 15-20 hours if wind NE to S. Early summer A.M. often afternoon thunder showers. Other winds overcast.

9

H9—CIRROCUMULUS
Ice clouds. Precipitation likely 15-20 hours if wind NE to S. Early summer A.M. often afternoon thunder showers. Other winds overcast.

10

H7—CIRROSTRATUS with halo
Precipitation likely within 15 to 24 hours if wind steady from NE to S. Prismatic effect of sun or moon through ice crystals cause halo.



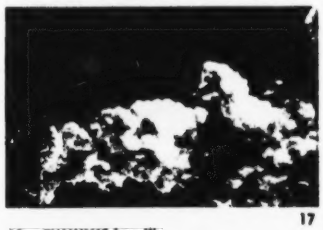
M1—ALTOSTRATUS translucidus
Precipitation likely within 10 to 2C
wind is steady from NE to S. Sun ap
hind frosted glass. Other winds ove

15

M3—ALTOSTRATUS translucidus
Precipitation likely in 10 to 15 hours if winds steady NE to S. Sun appears to be behind frosted glass. Other winds bring overcast sky.

16

M1—ALTOSTRATUS translucidus
Precipitation likely in 10 to 15 hours if winds steady NE to S. Sun appears to be behind frosted glass. Other winds bring overcast sky.



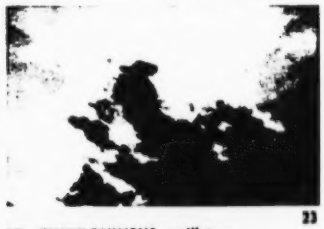
17

L1—CUMULUS humilis
Fair weather clouds if they show no vertical development. Can build up and develop into cumulus congestus or cumulonimbus clouds.

L2—CUMULUS with vertical growth
Fair weather clouds building up
often indicate cumulus congestus a
lonimbus which bring afternoon sh

22

L9—CUMULONIMBUS
Precipitation likely and soon coming usually from SW W to N. Distant clouds often show an anvil-shaped cirroform cap.



23

L9—CUMULONIMBUS capillatus
Precipitation likely and soon coming usually from SW W to N. Distant clouds often show an anvil-shaped cirroform cap.

24

L3—CUMULONIMBUS calvus
Precipitation likely and soon coming usually from SW W to N. Distant clouds often show an anvil-shaped cirroform cap.

L5—STRATOCUMULUS stratiformis
Immediate threatener of bad weat
sprinkle to heavy precipitation. If
cold front, gusty winds or thunde

29

L9—NIMBOSTRATUS
Rain or snow clouds. Precipitation of long duration if winds NE to S, or shorter duration if winds are from SW W to N.

30

L9—NIMBOSTRATUS
Rain or snow clouds. Precipitation of long duration if winds NE to S, or shorter duration if winds are from SW W to N.

31

L2—CUMULUS congestus with Fracto stratus of bad weather
Precipitation of long duration if winds from NE to S, or shorter duration with other winds.

L1—CUMULUS fractus
Fair weather clouds broken up
winds. No precipitation unless win
NE to S, then cumulus fractus of bad

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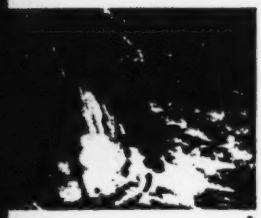
Cloud Chart

HIS CHART HAS BEEN PREPARED TO AID IN THE INTERPRETATION OF CLOUD REPORTS IN THE INTERNATIONAL FIGURE CODE

Below the equator
opposite the wind
justment made for



3

RUS uncinus spreading over sky
clouds. Good weather if winds from
N. Precipitation likely within 20 to
if winds steady from NE E to S.

4

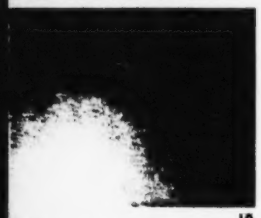
H6—CIRRUS above 45°
High ice clouds. Good weather if winds from W NW to N. Precipitation likely within 20 to 30 hours if winds steady from NE E to S.

5

H6—CIRROSTRATUS covering sky
Precipitation likely within 15 to 25 hours if winds steady from NE E to S, or sooner if winds SE to S. Other winds bring overcast sky.

6

H6—CIRROSTRATUS covering sky
Ice clouds cover sky. Precipitation likely within 15 to 25 hours if winds steady from NE E to S. Other winds bring overcast sky.



10

ROSTRATUS with halo
ion likely within 15 to 24 hours if
dy from NE to S. Prismatic effect of
oon through ice crystals cause halo.

11

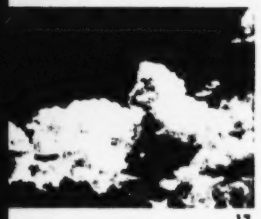
M1—ALTOSTRATUS translucidus
Precipitation likely within 10 to 20 hours if wind is steady from NE to S. Sun appears behind frosted glass. Other winds overcast sky.

12

M3—ALTOCUMULUS translucidus
Water and ice clouds. Some precipitation likely within 15 to 20 hours if wind is steady NE to S. Other winds bring overcast sky.

13

M3—ALTOCUMULUS undulatus
Precipitation likely within 15 to 20 hours if wind is steady NE to S. Other winds bring overcast sky. Mostly threatens precipitation.



17

ULUS humilis
her clouds if they show no vertical
ent. Can build up and develop into
ongestus or cumulonimbus clouds.

18

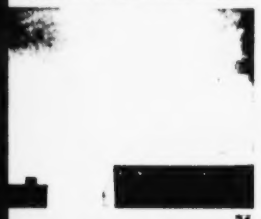
L2—CUMULUS with vertical growth
Fair weather clouds building up vertically often indicate cumulus congestus and cumulonimbus which bring afternoon showers.

19

L2—CUMULUS congestus
If clouds form from SW to NW precipitation with gusty winds and thunderstorms or only wind squalls are likely within 5 to 10 hours.

20

L2—CUMULUS congestus
Cloud tops forming altocumulus cumulogenitus usually bring precipitation in 5-10 hours, gutsy winds, thunder showers, wind squalls.



24

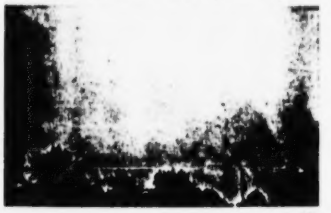
ULONIMBUS calvus
on likely and soon coming usually
W to N. Distant clouds often show
haped cirroform cap.

25

L5—STRATOCUMULUS stratiformis
Immediate threatener of bad weather from a sprinkle to heavy precipitation. If at head of cold front, gusty winds or thunder shower.

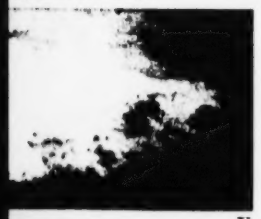
26

L5—STRATOCUMULUS opacus
Immediate threatener of bad weather from a sprinkle to heavy precipitation. If at head of cold front, gusty winds or thunder shower.



27

L6—STRATUS (Note tower fading in cloud)
Winds from NE to S may bring heavy precipitation. Other winds bring only light drizzle or an overcast sky.



31

ULUS congestus with Fracto stratus
weather
on of long duration if winds from
shorter duration with other winds.

32

L1—CUMULUS fractus
Fair weather clouds broken up by strong winds. No precipitation unless winds steady NE to S, then cumulus fractus of bad weather.

33

L5—STRATOCUMULUS at sunset
Low water clouds of dark Indian red color. Precipitation in 12 to 20 hours if winds from NE to S. Other winds bring overcast sky.

34

M5-H1—ALTOCUMULUS and CIRRUS at sunset
Middle water to ice clouds with brilliant white background. Precipitation likely within 20 to 24 hours if winds are from NE E to S.

e! Get up-to-the-minute coverage of weather conditions, forecasts and events, locally and
s interesting and informative weather facts and fun! 24 hours a day, and only on cable.

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'd Chart

NTERPRETATION OF CLOUD REPORTS IN THE INTERNATIONAL FIGURE CODE

Below the equator the prevailing winds are generally opposite the winds above the equator. With this adjustment made forecasts will be as noted below.

4

US above 48°

louds. Good weather if winds from N. Precipitation likely within 20 to f winds steady from NE E to S.

5

H6—CIRROSTRATUS covering sky

Precipitation likely within 15 to 25 hours if winds steady from NE E to S, or sooner if winds SE to S. Other winds bring overcast sky.

6

H6—CIRROSTRATUS covering sky

Ice clouds cover sky. Precipitation likely within 15 to 25 hours if winds steady from NE E to S. Other winds bring overcast sky.

7

H9—CIRROCUMULUS

Ice clouds. Precipitation likely 15-20 hours if wind NE to S. Early summer A.M. often afternoon thunder showers. Other winds overcast.

11

STRATUS translucidus

on likely within 10 to 20 hours if ady from NE to S. Sun appears be- d glass. Other winds overcast sky.

12

M3—ALTOCUMULUS translucidus

Water and ice clouds. Some precipitation likely within 15 to 20 hours if wind is steady NE to S. Other winds bring overcast sky.

13

M3—ALTOCUMULUS undulatus

Precipitation likely within 15 to 20 hours if wind is steady NE to S. Other winds bring overcast sky. Mostly threatens precipitation.

14

M3—ALTOCUMULUS perlucidus

Water and ice clouds. Some precipitation likely within 15 to 20 hours if wind steady from NE to S. Other winds bring overcast sky.

18

LUS with vertical growth

er clouds building up vertically ate cumulus congestus and cumu- which bring afternoon showers.

19

L2—CUMULUS congestus

If clouds form from SW to NW precipitation with gusty winds and thunderstorms or only wind squalls are likely within 5 to 10 hours.

20

L2—CUMULUS congestus

Cloud tops forming altocumulus cumulogenitus usually bring precipitation in 5-10 hours, gutsy winds, thunder showers, wind squalls.

21

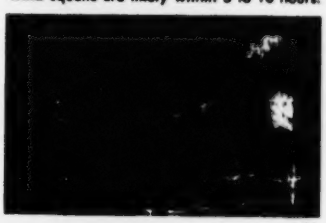
L2—CUMULUS congestus

If clouds form from SW to NW precipitation with gusty winds and thunderstorms or only wind squalls are likely within 5 to 10 hours.

25

OCUMULUS stratiformis

threatener of bad weather from a heavy precipitation. If at head of gusty winds or thunder shower.



26

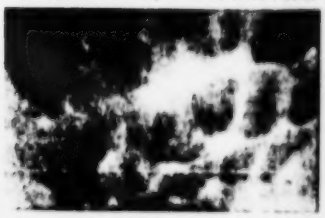
L5—STRATOCUMULUS opacus

Immediate threatener of bad weather from a sprinkle to heavy precipitation. If at head of cold front, gusty winds or thunder shower.

27

L6—STRATUS (Note tower fading in cloud)

Winds from NE to S may bring heavy precipitation. Other winds bring only light drizzle or an overcast sky.



28

L9—CUMULONIMBUS mamma

Seldom seen low to middle clouds. Associated with severe wind squalls, hail, heavy precipitation, tornadoes and thunderstorms.

32

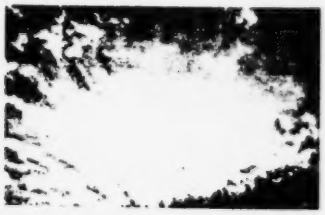
.US fractus

r clouds broken up by strong precipitation unless winds steady n cumulus fractus of bad weather.

33

L5—STRATOCUMULUS at sunset

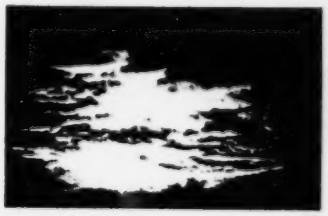
Low water clouds of dark Indian red color. Precipitation in 12 to 20 hours if winds from NE to S. Other winds bring overcast sky.



34

M5-H1—ALTOCUMULUS and CIRRUS at sunset

Middle water to ice clouds with brilliant white background. Precipitation likely within 20 to 24 hours if winds are from NE E to S.



35

L5—STRATOCUMULUS at sunset

Low to middle water clouds with gold, pink, amber, lavender or rosy background. No precipitation likely within 20 to 24 hours.

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